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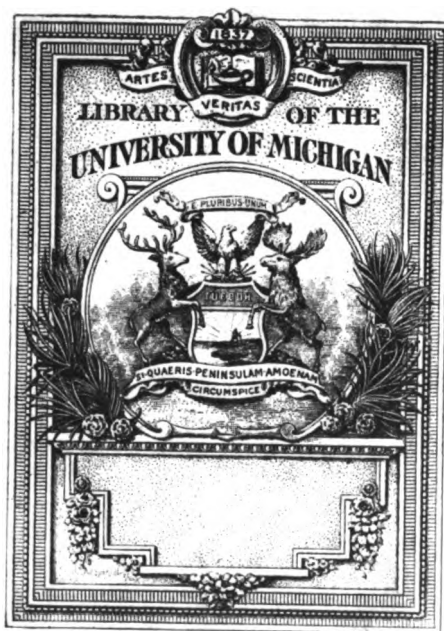
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# International Clinics













FRONTISPIECE—(FIG. 28.) Medullary carcinoma involving the entire breast, hemorrhage in one portion with fungus formation. Tumor 4 years. Painting of fresh specimen by Miss Hayes.

# INTERNATIONAL CLINICS

## A QUARTERLY

OF

ILLUSTRATED CLINICAL LECTURES AND  
ESPECIALLY PREPARED ORIGINAL ARTICLES

ON

TREATMENT, MEDICINE, SURGERY, NEUROLOGY, PEDIATRICS,  
OBSTETRICS, GYNÆCOLOGY, ORTHOPÆDICS,  
PATHOLOGY, DERMATOLOGY, OPHTHALMOLOGY,  
OTOLOGY, RHINOLOGY, LARYNGOLOGY,  
HYGIENE, AND OTHER TOPICS OF INTEREST  
TO STUDENTS AND PRACTITIONERS

BY LEADING MEMBERS OF THE MEDICAL PROFESSION  
THROUGHOUT THE WORLD

EDITED BY

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# CONTENTS OF VOLUME I

(EIGHTEENTH SERIES)

## TREATMENT

	PAGE
THE SANATORIUM. By LAWREASON BROWN, M.D.....	1
NOTES ON THE TREATMENT OF SYPHILIS BY THE INJECTION OF SOLUBLE SALTS OF MERCURY. By JEAN DARDEL, M.D.....	22
SOME CLINICAL ASPECTS OF BLOOD COAGULATION. By THOMAS R. BOGGS, M.D.....	31
SOME RECORDS OF THE VALUE OF THE OPSONIC TEST FOR DIAGNOSIS AND OF THE EMPLOYMENT OF VACCINES IN CERTAIN INFECTIVE CONDITIONS IN CHILDREN. By A. DINGWALL FORDYCE, M.D., F.R.C.P. (Edin.) .....	40

## MEDICINE

THE PARATYPHOID FEVERS. By JAMES C. WILSON, M.D.....	54
URINARY ACIDITY WITH SPECIAL REFERENCE TO GASTRIC ACIDITY.—ACID AND ALKALINE TIDES IN URINE DENIED. By A. L. BENEDICT, A.M., M.D.....	59
TEXTURAL PROCLIVITIES AND IMMUNITY: THE PERSONAL FACTOR IN MEDICINE. By SIR DYCE DUCKWORTH, M.D., LL.D., F.R.C.P. ....	72
MUCOUS COLITIS. By DAVID SOMMERVILLE, B.A., M.D., M.R.C.P.....	77
THE NORMAL TEMPERATURE OF THE BODY. By R. D. RUDOLF, M.D. (Edin.), M.R.C.P. (Lond.) .....	82

## SURGERY

DISEASES OF THE GALL BLADDER. By JOHN B. DEEVER, M.D.....	89
PRACTICAL DEDUCTIONS FROM A SERIES OF OPERATIONS FOR PERFORATED GASTRIC AND DUODENAL ULCER. By BENJAMIN T. TILTON, M.D. ....	105
RESECTION OF SHOULDER JOINT FOR SUPPURATIVE DISEASE OF THE BONE. By J. GARLAND SHERRILL, A.M., M.D.....	113
THE IMPORT OF DIGESTIVE DISTURBANCES IN THE DIAGNOSIS OF SURGICAL LESIONS OF THE ABDOMEN. By LOUIS FRANK, M.D. ....	123



## GYNÆCOLOGY

	PAGE
ON FIXATION ABSCESSSES. By JULES THIBOLOIX, M.D.....	128
THE CARE OF THE NEWBORN. By HENRY ENOS TULEY, A.B., M.D....	141
THE PERFECTED SURGICAL TREATMENT OF FIBROID TUMORS OF THE UTERUS. By LEWIS S. McMURTRY, A.M., M.D.....	156

## NEUROLOGY

FRACTURE OF THE SPINE. By GEORGE L. WALTON, M.D.....	163
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## PATHOLOGY

THE WAY OF INFECTION IN TUBERCULOSIS. By LAWRENCE F. FLICK, M.D. ....	171
ETIOLOGY OF HÆMOGLOBINURIC FEVER. By WILLIAM H. DEAD- ERICK, M.D. ....	174

## PROGRESS OF MEDICINE DURING 1907

TREATMENT. By A. A. STEVENS, M.D.....	190
INFECTIOUS DISEASES.....	190
CONSTITUTIONAL DISEASES.....	207
DISEASES OF BLOOD AND DUCTLESS GLANDS.....	209
DISEASES OF THE CIRCULATORY SYSTEM.....	213
DISEASES OF THE KIDNEYS.....	216
DISEASES OF THE RESPIRATORY TRACT.....	217
DISEASES OF THE DIGESTIVE TRACT.....	218
MEDICINE. By DAVID L. EDSALL, M.D., and VERNER NISBET, M.D.....	220
INFECTIOUS DISEASES .....	220
DISEASES OF THE RESPIRATORY TRACT .....	229
DISEASES OF THE GASTRO-INTESTINAL TRACT.....	229
DISEASES OF THE PANCREAS AND LIVER .....	231
METABOLIC AND RENAL DISEASES.....	235
DISEASES OF THE CARDIO-VASCULAR SYSTEM.....	235
DISEASES OF THE BLOOD VESSELS.....	240
THE BLOOD SERUM.....	244
DISEASES OF THE DUCTLESS GLANDS.....	247
DISEASES OF THE BLOOD.....	249
REFERENCES.....	252

	PAGE
SURGERY. By JOSEPH C. BLOODGOOD, M.D.....	256
THE PREPARATION FOR OPERATION.....	258
OPERATIVE TECHNIQUE.....	259
SURGERY OF THE BONES.....	263
SURGERY OF THE THYROID GLAND.....	270
SURGERY OF THE BREAST.....	272
SURGERY OF THE JOINTS.....	276
SURGERY OF THE ABDOMEN.....	278
HERNIA .....	292
SURGERY OF THE COLON.....	298
SURGERY OF THE INTESTINES.....	301
SURGERY OF THE BRAIN.....	302
SURGERY OF THE SPINE AND PERIPHERAL NERVES.....	303
SURGERY OF THE TESTICLE.....	304
SURGERY OF THE KIDNEY.....	304



# LIST OF ILLUSTRATIONS TO VOLUME I

## (EIGHTEENTH SERIES)

### COLORED PLATES

	PAGE
FRONTISPICE. Medullary carcinoma involving the entire breast.	
PLATE I. Figure 1. Multiple myeloma.....	280
"    Figure 2. Vascular, spindle and round celled sarcoma.....	280
"    Figure 3. Hypernephroma of kidney, section through tumor and part of kidney.....	280
PLATE II. Figure 1. Chronic appendicitis showing perforation.....	288
"    Figure 2. Carcinoma of stomach, tumor at pylorus.....	288
"    Figure 3. Fibro-myxo-chondroma arising from the periosteum of the calcis.....	288

### PLATES

Reception Hospital. Saranac Lake, N. Y.....	4
First Floor Plan of Reception Hospital.....	4
Second Floor Plan of Reception Hospital.....	4
Moore Cottage in Winter.....	4
Floor Plan of Moore Cottage.....	4
Veranda Child's Memorial (Infirmary).....	4
Child's Memorial (Infirmary) Adirondack Cottage Sanitarium.....	10
Ground Floor of Infirmary Building.....	10
Outdoor Workshop .....	18
Temperature chart of paratyphoid fever.....	56
Sinuses following post-typhoid osteomyelitis of the ribs.....	262
Syphilitic ulcers of nose and upper lip.....	262
Simple ulcer of tongue.....	263
Benign bone cyst of lower end of femur.....	264
Adamantine epithelioma of lower jaw.....	264
Malignant naso-pharyngeal tumor.....	265
Tubercular caseous focus in the femur.....	268
Recurrent giant cell sarcoma, lower end of radius.....	268
Forearm and hand showing deformity from resection of lower end of radius	268
X-ray result after removal of tumor shown in Fig. 10.....	268
Giant cell sarcoma, lower end of radius.....	268
Photomicrograph of cicatricial keloid.....	268

	PAGE
Pure myxoma of bone.....	268
Intracanalicular myxoma of the breast, with sarcomatous areas.....	269
Spindle and round cell sarcoma of lower end of femur.....	269
Focal areas of exophthalmic hypertrophy.....	270
Photograph of patient with recurrent simple goitre.....	271
Larynx, trachea, thyroid gland in substernal thyroid tumor.....	271
Local recurrence near scar, after excision of the breast only, for carcinoma	272
Gross appearance of recurrent carcinoma shown in Fig. 22a.....	272
Ultimate result after complete Halsted operation.....	273
The tissues which are removed in the complete Halsted operation.....	274
Dimpling of the skin in early carcinoma of the breast.....	274
The bulging of the breast in doubtful and non-malignant tumors.....	275
The gross appearance of carcinoma.....	275
Small fibroadenoma near a simple cyst of the breast.....	276
Dilated duct in senile parenchymatous hypertrophy.....	276
Photograph to illustrate the fixation of the scapula in subdeltoid bursitis..	276
Photograph of patient with chronic bursitis.....	276
Surface appearance of bursa in Fig. 32.....	276
Portion of the bursa with smooth wall in Fig. 32.....	276
Arthritis deformans due to gonorrhoeal infection.....	277
Photograph of patient to illustrate multiple drainage of the peritoneal cavity in appendicitis and general purulent peritonitis.....	282
The appearance of a callous duodenal ulcer at laparotomy.....	286
Small peritoneal fold, with intestine passing to the left.....	286
Extensive peritoneal fold which turns the intestine to the right.....	286
Peritoneal fold separated.....	286
Chronically inflamed and thickened gall bladder.....	286
Photograph of a complete slough of mucous membrane of the gall bladder	286
Chronic appendicitis with perforation of the tip of the appendix in the caecum .....	287
Intestines removed on account of gangrene due to mesenteric thrombosis..	290
Photograph of giant colon.....	298
Photograph of operation (Schapiro) to illustrate the method of appendi- costomy which is not advised for chronic colitis.....	300
Tubercular adenitis, glands of mesentery, with secondary involvement of wall of intestine.....	300
Carcinomatous tumor, upper third of rectum.....	302
Carcinomatous ulcer, lower third of rectum.....	302
Photograph of patient showing defect after exploratory craniectomy.....	302
Sarcoma of testicle; fibromyxosarcoma.....	303

## FIGURES

	PAGE
Diagram showing site of injection in gluteal region (Fig. 1).....	25
Chart showing proportion of mercury in the various soluble salts (Fig. 2)	29
Coagulometer of Russell and Brodie as modified by Boggs (Fig. 1).....	33
Diagram to illustrate the movement of the cells during coagulation (Fig. 2)	34
Chart to show variations in urinary acidity (Fig. 1).....	63
Suggestion for normal temperature chart (Fig. 1).....	87
Diagram to show areas of anæsthesia after fracture of the vertebræ (Fig. 1)	164
Diagram to show area of anæsthesia after fracture of the vertebræ (Fig. 2)	167
Diagram showing how the brachial segments of the cervical region send their distribution down the arm (Fig. 3).....	168
Position of arms in case of destruction between fifth and sixth cervical segments (Fig. 4) .....	169



# Treatment

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## THE SANATORIUM

BY LAWRASON BROWN, M.D.

of Saranac Lake, New York

---

*Historical.*—The history of the sanatorium treatment, originated by Brehmer in 1859, grew slowly for some years, fostered by the originator, Dettweiler, Turban, and a few others in Europe and by Trudeau and later by Bowditch in America. During the last decade the movement has received a remarkable stimulus all over the civilized world, but Germany has been preëminent and with the income derived from its compulsory invalidity insurance laws, first suggested by Gebhard, for all workmen whose annual income is below 2000 marks (about \$500), has been enabled to deal most effectually with the problem. When a workman falls ill of tuberculosis he is sent at once without expense to himself to one of these sanatoriums for three months. Hoffman has shown that private industrial companies cannot attempt this. Austria, Italy, Norway and Switzerland have followed Germany's lead in compulsory insurance. In England the sanatorium treatment received a great stimulus from the excellent work of Walther but the possibilities of such treatment were greatly over-rated and the necessity for careful discrimination in the selection of the patients was overlooked. The inevitable result has been a discussion of the question: "Is the sanatorium worth while?"

Trudeau in America in 1884 founded the first sanatorium for the poorer classes, and by his wonderful enthusiasm has not only maintained it but stimulated the erection of many others. V. Y. Bowditch of Boston founded the first sanatorium in America in a "home" climate and proved by his splendid results that the hygienic-dietetic treatment was the essential factor, and that "climate," inaccessible to many, was not necessary for many



patients. He was also instrumental in founding the first state sanatorium at Rutland, Mass. At present a large number of states and some municipalities have established sanatoriums. Much credit for untiring work in popularizing the sanatorium idea belongs to von Leyden in Germany and Knopf in America.

*The Site.*—The sanatorium site should be on rising ground, higher than most of the surroundings (to avoid fogs), well protected from but not entirely shut off from the prevailing winds by hills or by woods, preferably of mixed foliage with evergreens predominating, commanding exposure to the sun and a pleasing, interesting and varied view, with a virgin (if possible), dry, porous (sand or slate, never clay), well drained soil. The situation should be sufficiently remote to ensure purity of air. The population of the surrounding country should be sparse and healthy; factories, foundries, mills and smelters should be absent. While easy of access both by rail and by good highways, it should be well protected from the smoke of the one and the dust of the other. At least one acre per patient is required and if farming is contemplated more is necessary. Good, potable water should be present in abundance and a lake or dam whose overflow could be utilized as water power is a valuable asset. The question of disposal of sewage is to be considered in regard to the site as well as opportunities for wooded, graded walks. Ample vegetation prevents dust.

The situation of a sanatorium near a large city from which its patients are mainly drawn has advantages and disadvantages. The chief advantage is its educational value to a large number of people, though the longer and more intimate visits to the more distant sanatorium afford greater educational advantage but to a more limited number. Homesickness is a factor of little importance as it lasts but a few days in most cases. A disadvantage of no small importance is the fact that many patients, encouraged by their friends and relatives, refuse to remain a sufficient length of time to derive any permanent benefit.

Sanatoriums have done more than any other factor to prove that the hygienic-dietetic treatment is vastly more important than climate *per se*, for situated at low levels, near the sea or in the interior, at moderate or high elevations, in temperate or cold cli-

mates, the results with suitable patients have been uniformly gratifying.

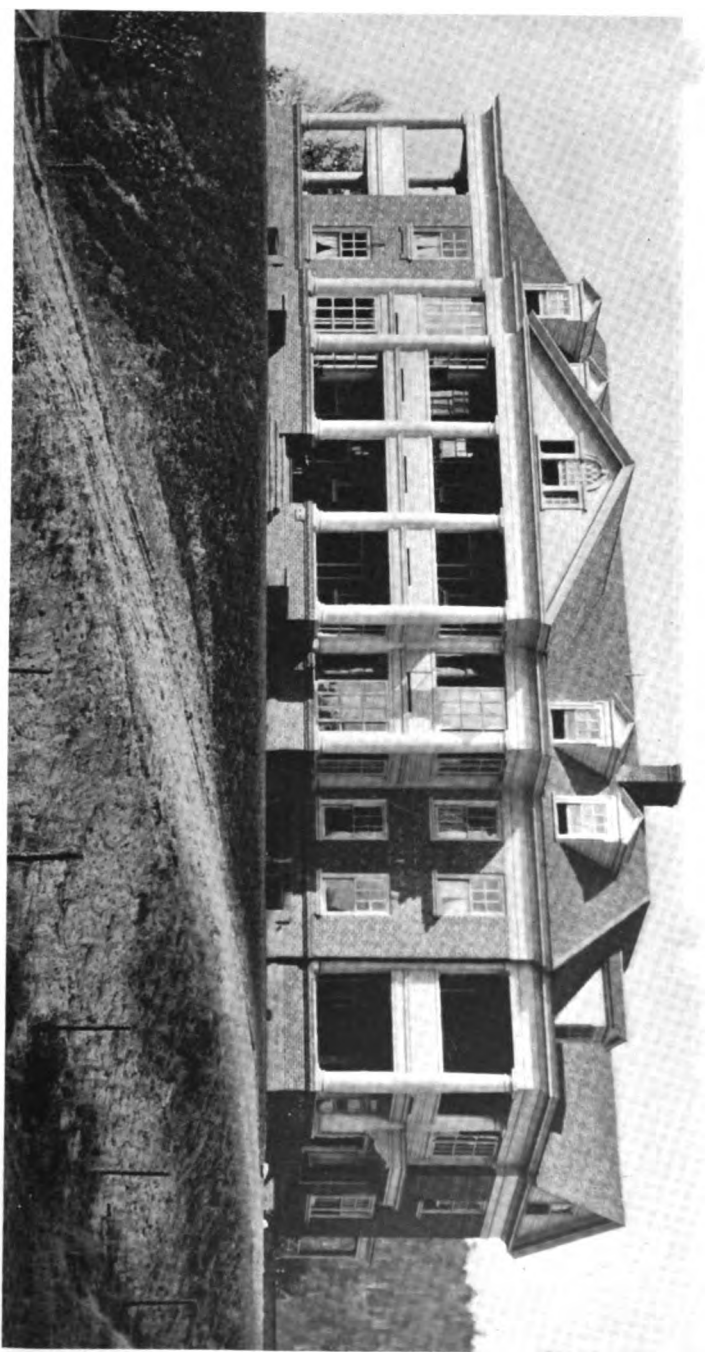
*Cost.*—The cost of construction varies with the locality, its accessibility, the plan of construction as well as the material. The cost is always greater in a cold climate. Brick and stone while more expensive at first are much more durable than wood, which needs frequent painting. One of the most economical forms of construction consists of lean-tos grouped around a central administration building. King has estimated that such a sanatorium, accommodating 150 patients, would cost \$80,000 or about \$533 per patient. Additional patients can be "housed" by this method at a cost of \$100 to \$115 per patient. The cost of the cubicle of Burton-Fanning without lavatory or other accommodations, he estimates at \$60 per bed. It is difficult to construct sanatoriums on the continental (hotel), the pavilion or cottage plan for less than \$1000 to \$5000 per patient and a few sanatoriums have cost as high as \$10,000 per bed. Tents, shacks, villas, chalets, cubicles, etc., all cheapen the cost of construction. In large buildings the more stories gotten under one roof, the cheaper is the cost. The size of the sanatorium determines largely the cost, and an institution of 100 to 110 beds has been found to be most economical, and to give the best results. The cost of construction has been borne by private individuals, by insurance companies, by fraternal organizations as well as by state and municipal authorities.

*Plans.*—The sanatorium should be so constructed that the hygienic-dietetic treatment can be thoroughly, easily and comfortably carried out, that infectious matter (dust, sputum) can be easily and completely destroyed, and that the attractive buildings are appropriate for the climate, the site, and the class of patients, whether affluent, competent or indigent, for which they are intended. There must be accommodations for the patients, the staff, and the employees, for sleeping, eating, for rest and exercise out of doors, for recreation, and for nursing those acutely ill; offices both medical and administrative; a well equipped laboratory; a disinfecting and cleaning (vacuum) plant including a crematory; a power house, laundry, workshop and electric plant; stables; store houses for supplies, ice, trunks, etc.; a chapel; a mortuary and possibly an operating room and a room for hydrotherapy.

*Single Building.*—The single structure in sanatorium construction is in general cheaper to build and to maintain. The earlier continental sanatoriums were often modified hotels and lacked many conveniences for the hygienic-dietetic treatment. The building should not be over two or at most three stories and lifts should be provided. The rooms are best arranged in a single row and the building should face south-south-east or south-south-west, with two wings at a slight angle to the central portion. The floors of rooms and halls should be deadened. The open windows render this useless for the walls. Rattling windows and slamming doors should be guarded against. The sanitary arrangements should be in towers well separated by a vestibule from the main building or in wings in cold climates. They should be opposite the stairs as all rooms should have, whenever possible, windows in the halls opposite the doors. The objections to the single structure are that it is noisier, harder to ventilate, the separation or isolation of patients is more difficult, it is less easily enlarged, and most important it is difficult to provide each room with a veranda without blanketing the rooms below. Wards are not to be recommended but a few rooms for two to four patients may be provided. As far as possible each patient should have an individual room. The patients under this plan sit out in "liegehallen," etc., where all can be watched.

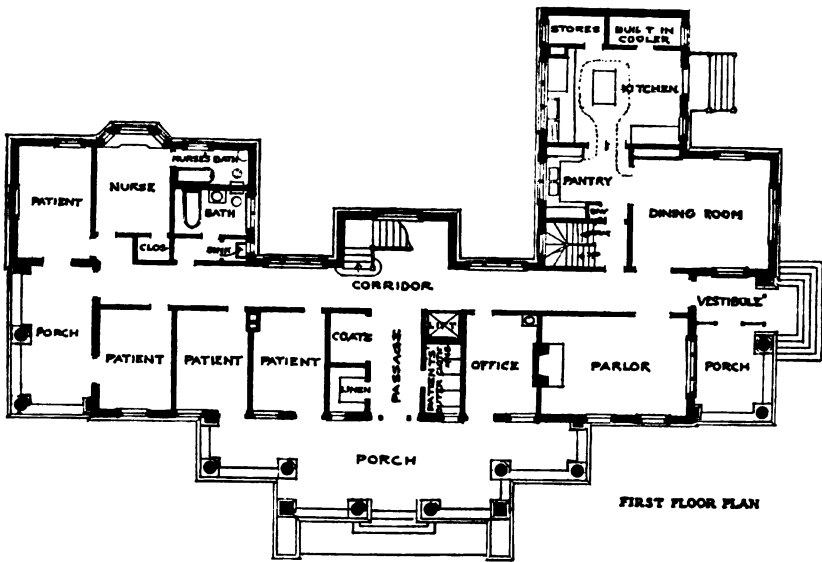
*Separate Buildings.*—Separate structures vary greatly in cost of construction, being the cheapest (tents, shacks, lean-tos, chalets, etc.) or the most expensive (elaborate pavilions or cottages). These plans always necessitate a central administration building containing the dining-room, kitchen, medical offices, laboratory and quarters for the medical, nursing and administrative staff. Such plans entail on the whole greater expense of maintenance and an exposed walk often of some extent to meals (practically of little or no importance) and the patients cannot be closely watched. On the other hand separate porches are provided for every two to four patients, where the patient can spend the day and night in bed, or when up, in comparative, or if necessary, absolute seclusion. Large well-lighted and ventilated closets are provided. Isolation is easily accomplished and enlargement of the plant is easy. Four is the most suitable number of patients for each cottage.

Fig. 1.



RECEPTION HOSPITAL  
SARANAC LAKE, N. Y.  
(*Scopes & Peusmann, Architects*)

FIG. 2.



RECEPTION HOSPITAL  
SARANAC LAKE, N. Y.

FIG. 3.

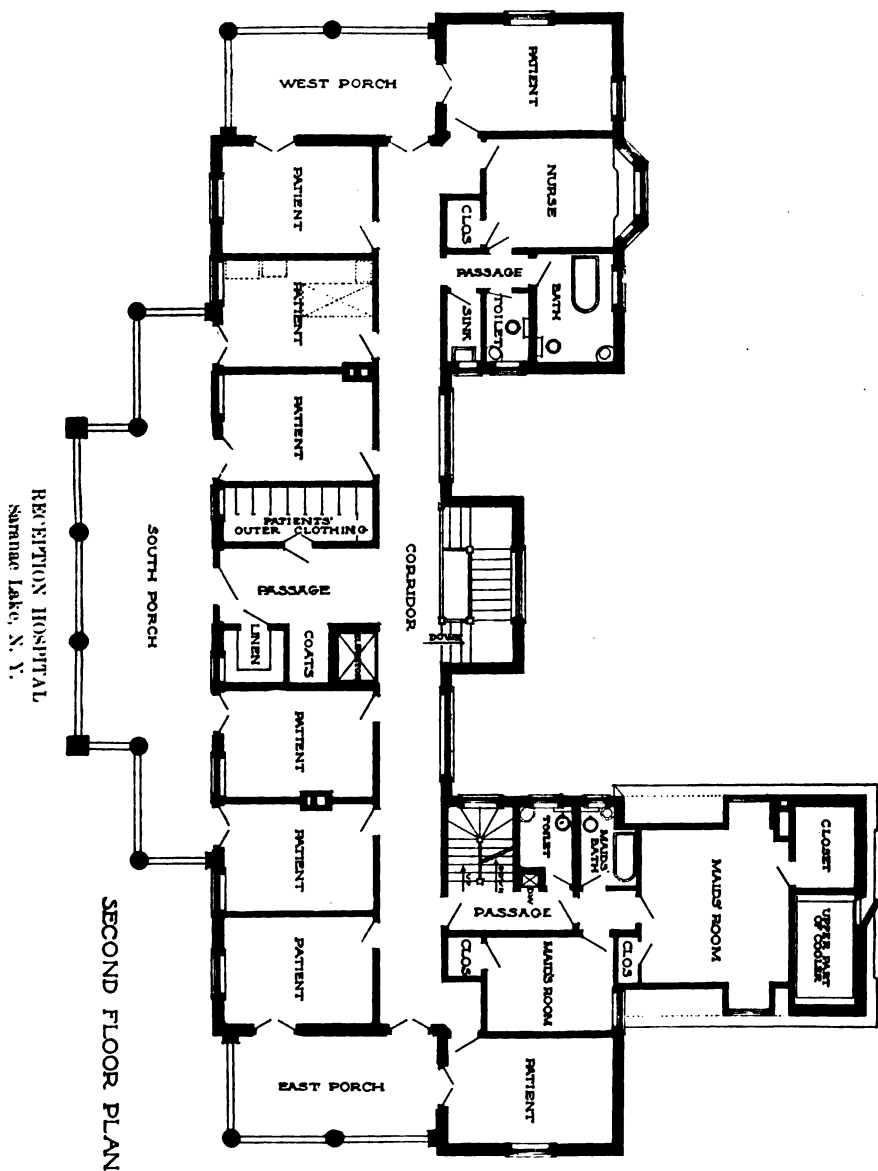
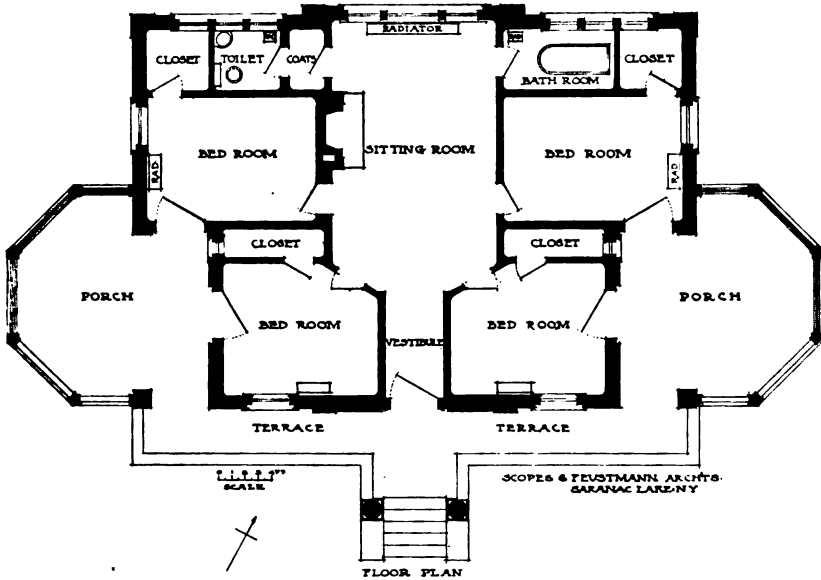


FIG. 4.



MOORE COTTAGE IN WINTER  
Adirondack Cottage Sanitarium

FIG. 5.



FLOOR PLAN OF MOORE COTTAGE  
Adirondack Cottage Sanitarium

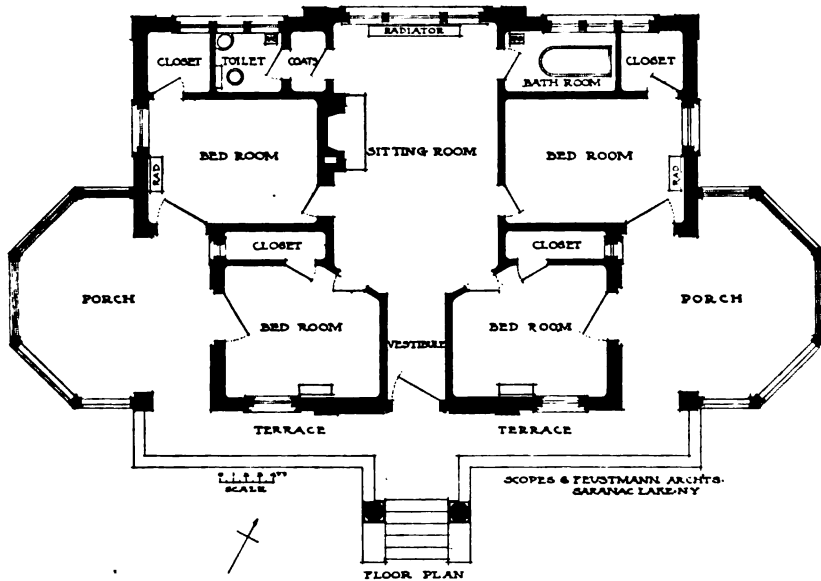


**FIG. 4.**



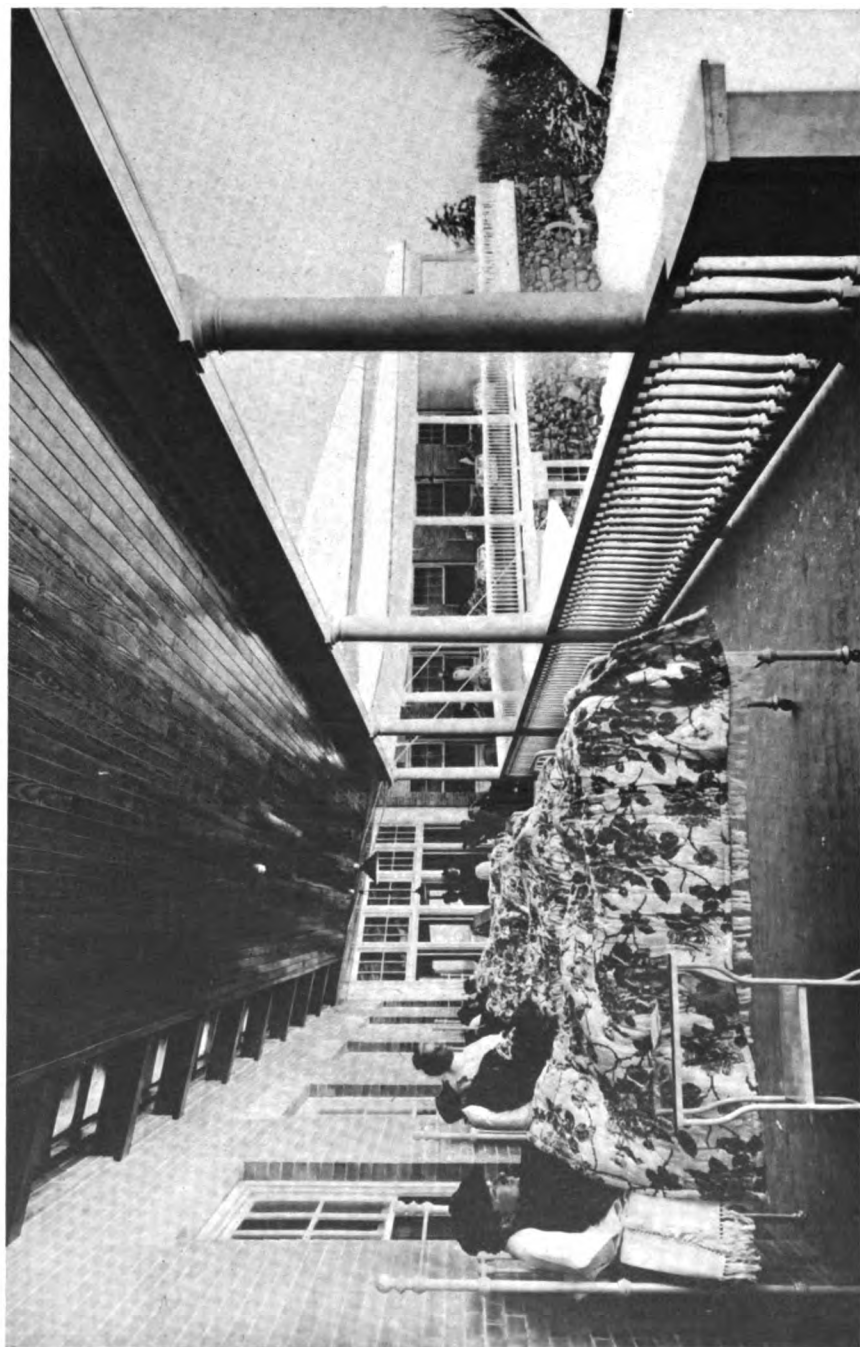
**MOORE COTTAGE IN WINTER**  
**Adirondack Cottage Sanitarium**

FIG. 5.



FLOOR PLAN OF MOORE COTTAGE  
Adirondack Cottage Sanitarium

FIG. VI



VERANDA CHILD'S MEMORIAL (INFIRMARY)  
Adirondack Cottage Sanitarium

The pavilion system, where, in a building of two stories, each patient has a separate room which opens by a wide door on a veranda, with a nurse constantly present on each floor, which accommodates 12 patients, is an excellent if not the best plan. A central administration building is necessary and one pavilion with a dining-room and kitchen should be set apart for patients who become acutely ill. The floor plan of the cottage in figure V, designed by Scopes and Feustmann, has two covered porches (communicating by a narrow front porch) on which all four bedrooms open by doors, so arranged that the bed can be wheeled out. The rooms all face south and are provided with large well-lighted and ventilated closets for clothes.

*Veranda.*—The advisability of verandas, “*liegehalle*,” shacks, camps, etc., not opening off the bedrooms where the patients may sit or lie out of doors is questioned. The great advantage of a common structure for sitting out is that the patients can be more easily watched. If such structures be erected a few small porches are necessary for febrile patients. *Liegehalle* with patients lying or sitting four feet apart with screens interposed are excellent notwithstanding some opposition. Properly constructed they can be easily cleaned. Separate structures for winter and summer are necessary or the back may be removable and screens placed upon the south front. If the cottage or lean-to system be adopted these structures are not necessary. All verandas should be eight to ten feet deep and protected on one or two sides with sliding glass, not reaching to the roof. Two sides should always be open. Many glass cages, or “*sun-parlors*,” in which some patients sit are abominations.

Comfort, not luxury, should be sought in all buildings, which should be pretty, and plain, not imposing. Liveableness as well as architectural beauty should be aimed at. The grounds should be attractive, well wooded, with paths, level and at slight gradients (2, 5 and 10 per cent.). Every room, which, freely open to the light, may face in any direction, but more particularly every veranda, should command a pleasing and extensive view, which is especially important for the infirmary. Buildings should rarely be over two stories with all the bed-rooms in a single row and men and women should occupy separate wings or cottages but may

be allowed to mix in daily life. A closet, bath and lavatory should be provided for every four or five patients and well lighted and ventilated rooms for wraps. Every building should have a cellar or be raised four feet above the ground. This space should be ventilated.

*Ventilation.*—The air of no building, however well ventilated, can ever equal that out of doors and for this reason all plans should be so drawn that the patients can live continuously or nearly so in the open. No closed system of ventilation is good. All windows should be large, and reach to the ceiling.

*Light.*—Every room and passage should be flooded with light, preferably direct sunlight and a dark room is an anomaly. The sanatorium should be lighted with electricity; and gas, unless acetylene, should not be used. Candles are better than coal-oil lamps.

*Heating.*—A central plant should be installed when possible. Hot water or steam under low or, less desirable, under high pressure, are the best methods. All radiators should be perfectly plain, nine inches from the floor and wall. Electric heating is too expensive. Wood-stoves are better than coal or coal-oil stoves. Hot air unless especially treated is too dry. The incoming air should not be heated and sudden variations of temperature are to be avoided. The temperature of the bedrooms should be 60° night and morning; that of the dining room 55° to 58° at the beginning of a meal. Open fire places are valuable spring and fall. Open fire-places upon exposed verandas create an unpleasant draught.

*Sewage.*—The question of sewage disposal is most serious. When access to the sewers of a corporation can be had the problem is simple but in more or less thickly populated districts where the mains are not accessible and where laws prohibit the emptying of sewage into the streams or rivers the matter demands considerable attention in the selection of a site. The septic tank or sewage disposal beds are probably the best systems. Subsurface irrigation is not so good except for slop water. The overflow from septic tanks should not be used to irrigate fields where food for man is grown though if all sputum were burned there would be little danger.

*Floors.*—The floors of all bed-rooms should be of hard wood

(oak, pine or teak), or of soft wood covered with linoleum, laid with a fillet. The floors of all passages much used, the dining room, kitchen, should be of artificial stove tiling, or rubber.

*Walls.*—The walls should be painted with a light-colored enamel paint or less desirable with a washable water paint. Glazed tiles may be used to a height of five feet but are very expensive.

Stair-cases may be built without rises or with rounded corners. They should never be steep and the product of the rise by the tread in inches should approximate 77. Stair-cases may aid in the spread of impure air.

*Bed-rooms.*—The individual rooms should be at least 12 x 10 x 10 with a floor space of 120 square feet, so arranged that the bed never occupies a corner. The windows, easily opened, at least two in number, should reach to the ceiling and within 2½ feet of the floor in which case transoms are not necessary. One window should be double-hung with a jib door, or be replaced by a Dutch door at least four feet wide, allowing the bed to be rolled out upon a well sheltered (from wind, rain and snow, and sun if necessary) but never enclosed veranda (8–10 feet deep) well lighted with electricity, where the patient should be kept while confined to bed or where he may sleep. It is much safer to sleep on such a porch than with the head out of a window, where draughts may cause otitis, etc. The doors should be flush-panelled and all the trim plain, smooth and rounded. The corners may be rounded or truncated with two obtuse angles (135°). An electric bell should be in each room and on the veranda.

*Furniture.*—The furniture should be plain and simple, raised high from the floor, well varnished inside and out as well as below. It should include an iron bed on rollers, a bureau, or a chiffonier, two chairs, a bed-table, and a wash stand with its china, which should be as light as possible. The shelves should be of plate glass and a washable laundry bag should be provided. Upholstering unless leather or removable and washable is not to be used. Plain washable curtains, not extending to the floor, and screens with washable hangings may be permitted. Each bed-room should have one or two small rugs.

*Dining-room.*—The dining-room should be the most attractive

place in the sanatorium and economy should enter here last. It should be particularly well ventilated but free from draughts. Here transoms over the windows with side fans are desirable. Odors from the kitchen should be carefully excluded by passageways and cross aërial ventilation and electric fans employed to aid the ventilation if necessary. Two sides at least of the dining-room, which should allow 300 cu. ft. per patient and be at least 24–30 feet high, should consist almost entirely of glass. The temperature of the room should be 55°–58°F. at the beginning of each meal. The linen should be kept scrupulously clean and small celluloid or closely woven cloth receptacles should be provided for the napkins when not in use. When great economy is necessary smooth easily cleaned tables are to be preferred to oil-cloth covers and paper napkins may be provided. Under such circumstances enamelled ironware may replace the usual crockery.

*Kitchen.*—The large, airy, light and scrupulously clean kitchen should be slightly higher and well separated from the patients' quarters as no odor of cooking should ever enter any other room. A dish-washing and disinfecting machine is a necessity. A well arranged diet kitchen with special hot-water heated dishes for trays is important. Great care should be exercised with everything pertaining to the table and especially in regard to the trays.

*Laundry and Disinfection.*—The receiving room of the laundry should have no other connection with it but through a high pressure steam sterilizer through which all laundry should be passed. The clothes collected in special bags should not be opened until sterilized. Special provision must be made for fabrics that cannot be thus treated. The use of handkerchiefs should be forbidden and cheese cloth or gauze be supplied freely to the patients. After use it should be burned. All blankets, mattresses, pillows, and comfortables should be disinfected with formalin and live steam. (See Latham Prize Essay for King's Sanatorium, *Lancet*, Jan., 1903; Ransome, Principles of Open-Air Treatment of Phthisis and of Sanatorium Construction.)

*Farm.*—A farm connected with the sanatorium reduces the running expenses slightly if at all, but greatly improves the table and ensures pure and rich milk as well as fresh vegetables and fruit in abundance.

**Records.**—The most careful clinical work can be done only in the sanatorium, and for this reason the clinical histories and records should receive painstaking attention. Where the assistants are frequently newly graduated physicians the routine work should be full and exact; where such is not the case as soon as any routine procedure is found to be of little value it may be discarded. The anamnesis should contain full details of the exposure to tuberculous infection (an important reason for recording "family history"), of the conditions of the home, of the food, of the hours of work (inside or out) and rest, of the conditions at the office, workshop or factory, of the various organic systems, especially the digestive tract and of many other points that excite interest from time to time. A running account of the present illness should be followed by an inquiry about special symptoms. The "status præsens" should include the details of a complete physical examination, special sheets being reserved for the examination of the lungs. The pulmonary condition on admission and discharge should be charted, but a full description in writing entered on the records. Abbreviations may be used in history taking but a key should always be appended. Signs and symbols for the charts may be freely used. (See A. Moeller l.c., p.10, Musser, *Medical Diagnosis* 1900, p. 542, Elliott, *Canadian Jr. of Med. & Surg.*, Nov., 1904.) The lungs and sputum should be examined monthly and every attempt made to vary the monotony of routine by the application of new methods. The urine should be examined every second month unless some complication arises. When possible the patient's temperature, pulse and respiration should be followed continuously but where this is impossible a week on admission and on discharge and two or three days every month affords a good check on the temperature. The temperature should be taken during rest, and not shortly after meals and if possible in the patient's room or on his veranda. The patient's weight should be recorded weekly at the same time of day.

The post-discharge records are of great importance. Each year a brief blank report with a stamped and addressed envelope should be sent to each patient. This report should have on it the patient's name, present and permanent address, occupation,



the name and address of the physician, the presence or absence of cough, expectoration, (including tubercle bacilli), pleurisy, shortness of breath, hæmorrhage, nightsweats, weight, statements in regard to comparison of present health with that on discharge, in regard to relapse and a blank space for information about other patients. In sending out blanks for reports no envelopes with printed heads should be used which might injure a former patient with his employers.

In order to discuss intelligently the results of any treatment some classification must be adopted and that proposed by the National Association for the Study and Prevention of Tuberculosis has proved the most satisfactory. One week after arrival the patient's condition on admission should be decided upon and recorded. His condition on admission and on discharge should never be simultaneously decided upon after discharge.

In order to facilitate the work and to render it more accurate all records to be used in any medical report of immediate or remote results should be transferred to cards not over  $5\frac{1}{2} \times 4$  inches. The use of different colored cards to indicate the condition on admission lessens greatly the labor.

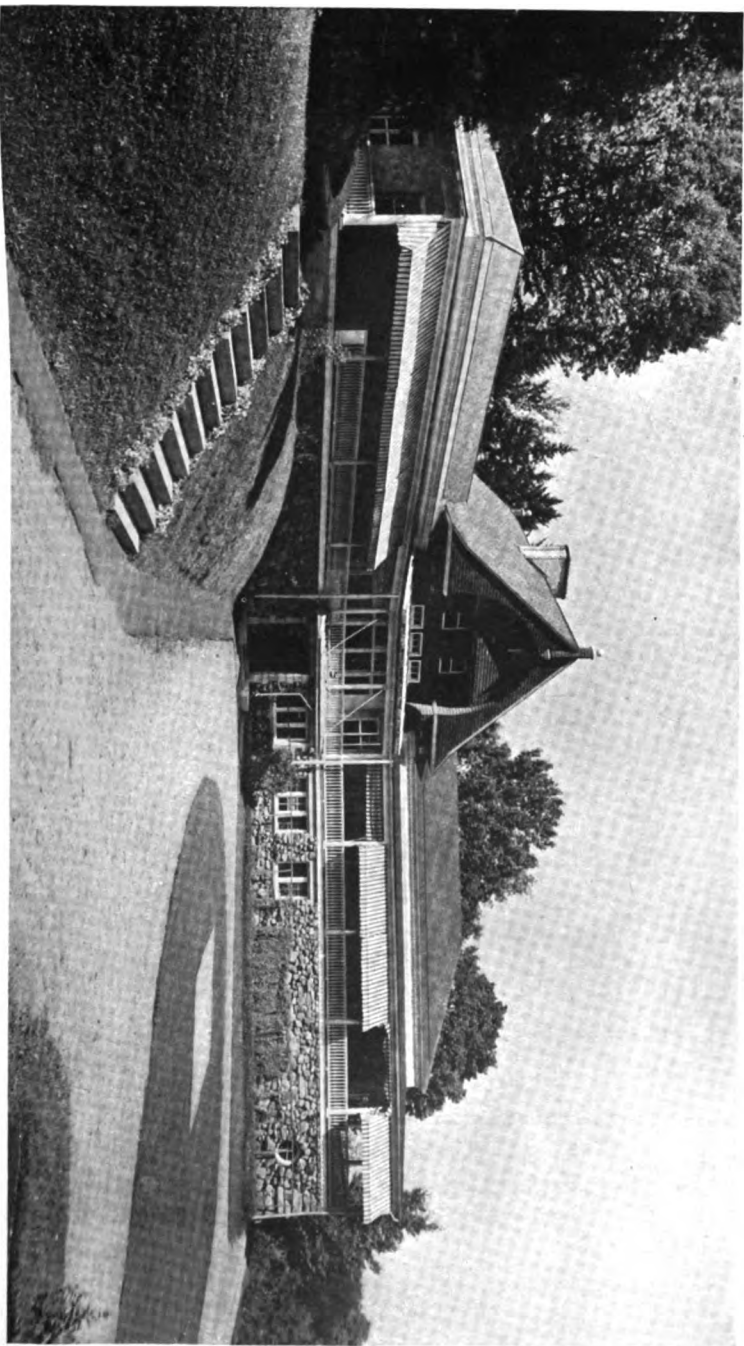
(See excellent articles by A. Moeller, *D. Deut. Klin.*, 1902, p. 118; Puetter & Kayserling, *D. Errichtung u. Verwaltung v. Auskunfts u. Fuersorgestellen f. Tb.* 1905, p. 41.)

It is advisable to record complete and accurate observation of the weather, noting the maximum and minimum temperatures, the amount of precipitation and percentage of possible sunshine, the velocity and direction of the wind, etc.

*Reports.*—The sanatorium should issue annual reports which should include financial and medical statements. It is almost impossible to compare the cost per patient in different institutions, for one may be in the midst of an agricultural country, another in a climate where farming is impossible; one may furnish many things, another may not and so on. The main interest however in all semi-charitable institutions centres around the deficit and fixed charge per patient. The medical report should include a statement about the condition of all the former patients as well as those discharged during the current year.

*Physicians and Nurses.*—The physician in charge of a sana-

**FIG. VII**



**CHILD'S MEMORIAL (INFIRMARY) ADIRONDACK COTTAGE SANITARIUM**

GROUND FLOOR  
or  
INFIRMARY BUILDING

• ADIRONDACK COTTAGE · SANITARIUM ·  
SARANAC LAKE, NY.

CHILD'S MEMORIAL (INFIRMARY)

torium should possess a strong and attractive personality, great tact, a sense of humor, and a calm, even, judicial temperament. He should be a good executive officer and disciplinarian, and when possible a good conversationalist. In brief besides being thoroughly conversant with medicine and with pulmonary tuberculosis he must be a versatile man, a physiologist, a dietitian and a chef. The physician should be in full charge of the sanatorium but should have an able executive officer to relieve him largely of the administrative work. A medical assistant for every 50 patients is ample. No man who has not had pulmonary tuberculosis can treat it as intelligently, as sympathetically and as cautiously as one who has recovered from it. Furthermore he is a constant source of encouragement to his patients. The best results are obtained only by individualizing the patients and as soon as possible the physician should come to know the mental temperament of each patient and establish a bond of sympathy between the patient and himself. Suitable and pleasant quarters embracing a reading-room, baths, and porches should be provided for the medical staff as no one who has not lived constantly with pulmonary patients can realize the relief it is occasionally to be able to rest apart from them. The physician should carefully examine the weekly dietary, should take one or two meals daily with the patients (at a separate table) or during the meal hour should pass among the patients, encouraging here and cautioning there, not only the patients, but the maids. In this way an *esprit du corps* may be obtained that will prove of great value. The medical offices and the resident physician's cottage should command a good view of the grounds though the latter may be screened from view by trees.

The number of the nurses necessary depends upon the condition and number of the patients. In institutions for incipient patients very few nurses are required, but some hold one nurse is necessary for every 8 or 10 patients. The qualifications of a suitable nurse are sympathy, tact, resourcefulness, and interest in the human as well as the medical problems of the patient.

The laboratory should be well equipped and scientific research encouraged. A special laboratory worker who is not encumbered with routine blood, urine and sputum examinations is a great

addition. A good library and a full list of the current medical journals are essential to all good work.

A small drug-room in isolated institutions is a necessity less for the treatment of the tuberculous disease than for the many non-tuberculous complications that arise during this treatment.

*Care of the Sputum and Disinfection and Cleaning.*—The care of the sputum should be above criticism, and the slightest infringement of rules about the sputum should be followed by summary dismissal. The sputum should all be burned and spitting into closets or lavatory-bowls (by no means an uncommon practice) must be guarded against. A 5 per cent. solution of carbolic acid should be where every patient can have access to it in case of accident. Prolonged contact of it with the sputum is necessary. Individual sputum cups should be provided and no general sputum boxes or cuspidors be allowed. Disinfection of the urine and feces is not necessary unless genito-urinary or intestinal tuberculosis supervene when extra precautions should be taken.

The clothing of many patients should be disinfected on arrival and it is a wise plan so to treat the clothes of all patients. On discharge it is a matter of less moment. In sanatoriums for the poor the provision of common clothes is a wise plan.

The rooms are best cleaned by the vacuum cleaning system but if this be not available wet cloths or mops should be used. Dry sweeping or dusting displaces but does not remove dirt. The cloths may be moistened in a 1-100 solution of chlorinated lime, a 5 per cent. solution of carbolic or 1-1000 solution of mercuric chloride.

The disinfection of rooms in a properly conducted sanatorium is unnecessary unless careless patients have occupied them. In a study of the dust from the cottages of the Adirondack Cottage Sanitarium only one specimen was found to contain tubercle bacilli and in this cottage a patient had been reported for carelessness (Hance). The bed, furniture and walls should be carefully cleaned and carbolized (5 per cent.) and the bedding (mattresses, pillows, blankets), and rugs, should be disinfected by steam under pressure or live steam and formalin in a specially constructed room. Every room should be fully renovated once or twice a year.

*Objects of the Sanatorium.*—The two main objects of sana-

torium treatment are healing and education, but in Germany where the insurance companies have established many sanatoriums and where the residence is but three months, the aim may be stated to be restoration of working capacity and education. They realize that when a person dependent for his livelihood upon his working power becomes tuberculous (pulmonary) he loses that possession which constitutes his fortune. They strive accordingly so to treat him that in three months he can return to work for a time at least. In many cases this simply prolongs the struggle. The arrest of every patient in a period of six to twelve months or less if possible should be the aim of every sanatorium. While it is impossible to arrest some, much less to cure them, the sanatorium educates them and many ultimately recover by means of the knowledge so acquired. They further spread abroad the gospel of prevention and dispel phthisiophobia.

*Objections to Sanatoriums.*—Many objections to sanatoriums have been advanced. The patients, except an occasional case, are far from unhappy or depressed, but more often encouraged by seeing the improvement others have made. Less time is offered for introspection. Gossip and conversation about symptoms cannot be avoided altogether and occasionally take place outside the sanatorium. The danger of the sanatorium to the community has been found not to exist (see Roempler, Baldwin, J. H. Elliott, Nahm, Oeby, etc.).

*Advantages of Sanatoriums.*—The constant supervision in regard to every detail of their life and the companionship of fellows in distress quickly does away in the vast majority of cases with any feeling of restraint or of homesickness. The habits of passive resistance which are so difficult to overcome in some patients outside of sanatoriums are quickly put aside. Many patients who remain in pleasure resorts frequented by well people make every attempt to keep up a pretence of well being; in a sanatorium where all is conducted on a basis of ill health this is never attempted. The close supervision of diet, of life out of doors, of rest, and of properly regulated exercise, for two or three months at the beginning of treatment is probably the chief advantage of the sanatorium.

*Employees.*—Isolated as many of the sanatoriums are, the ques-

tion of servants is a most serious one. The danger to maids is of little moment. No employee at the Adirondack Cottage Sanitarium ever contracted tuberculosis. Even when allowed the greatest laxity, given good quarters and good food it is impossible in many instances to obtain healthy employees and the difficulty in most sanatoriums is solved by employing old patients who often do remarkably well. Suitable sleeping-out quarters should be provided for them. All employees should wear rubber heels.

*Selection of Patients.*—Prognosis, upon which is necessarily based the selection of suitable patients for the sanatorium, is most difficult. Many patients apparently hopelessly ill recover, and a large number with apparently every chance of recovery do badly. This subject is so intimately connected with prognosis that it will be impossible to discuss here more than a few random points. Children under fifteen should not be admitted to sanatoriums for adults but should be sent to special institutions with educational advantages. Patients much over fifty have less chance of ultimate recovery. In general all patients with incipient or uncomplicated moderately advanced disease are suitable for sanatorium treatment, while all far advanced or hopeless cases should be refused. Patients with albuminuria, diabetes, or a persistent diazo-reaction, chronic diarrhoea, melancholia, profound neurasthenia, pregnancy, and all those with serious tuberculous complications are not suitable; while those with slight tuberculous complications such as slight thickening in the posterior interarytenoid space, slight superficial ulceration of one cord without infiltration, otitis media, fistula in ano, etc., often do well. A patient suffering from a second attack is much less likely to do well. Those with slight physical signs and pronounced symptoms, with marked and persistent tachycardia or pyrexia (at home and at rest), those who have steadily and rapidly declined both in their general and pulmonary condition since onset in spite of appropriate treatment, and those with marked dyspnoea and cyanosis are not suitable. The curability is, *ceteris paribus*, directly proportional to the age of the lesion. Inasmuch as change exerts such an important influence, those patients from unhygienic conditions often do better than those from more favorable environments. Patients in whom the disease has extended over a greater area than one lobe

or in whom the disease has advanced to cavity formation are not accepted by many sanatoriums and are certainly much less favorable. Where a slight infiltration is limited to one apex, or in fact to both apices, in other words where the disease is in the Turban-Gerhardt Stage I or II, the cases are eminently suitable for sanatorium treatment. It is foolish to expect an ultimate recovery in a patient who leaves at home a wife and large family who are utterly dependent upon the patient's own exertions.

When, however, all care has been used there are so many apparently suitable patients that rapidly grow worse that it renders selection of patients most uncertain. For institutions which are anxious to obtain for a time good results, the only safe plan is to have a large waiting list, to keep each patient some weeks under observation or to select from the list the most suitable cases, a practice which works much hardship upon the patients, and is not to be recommended. A probation cottage usually keeps full of patients with advanced disease unsuitable for sanatorium treatment.

Admission to the sanatorium for a short time on probation results in many patients with advanced lesions being allowed to remain the full term. Patients unsuitable for treatment are often admitted for sentimental reasons, and to keep the institution full, for the cost of maintenance remains usually the same and the patient brings in some income however small. He furthermore may be greatly benefited and certainly educated. (See Baldwin, *INTERNATIONAL CLINICS*, vol. iii, 1901.)

During the last few years many patients have unquestionably been treated for pulmonary tuberculosis who never suffered from it. The sanatorium should endeavor to exclude all such patients and every patient in whose sputum tubercle bacilli are not or have not been found should be subjected to the tuberculin test.

*Treatment.*—The treatment of patients in a sanatorium must be individualized and "hospitalization" avoided. Firmness not dogmatism should be aimed at in connection with all rules as well as great common sense. The patients act in many instances like children and the responsibility that rests upon the shoulders of a true sanatorium physician is not light nor easily borne. Many factors, such as the hygienic-dietetic treatment, the treatment of



fever, etc., cannot be discussed here and the following paragraphs refer mainly to afebrile patients, able to be up and about.

*Ordering of the Daily Life.*—On admission the patient should spend at least two weeks in the infirmary or reception cottage, where he is under close and constant observation and taught many things that require usually months for a patient to learn at home. Contact with other patients has a most salutary and beneficial educational influence. A few patients will always be found who cannot be taught caution. It is a grave problem, how much energy should be wasted upon such headstrong individuals for a time will come when an opportunity for a foolish action presents itself, is accepted, and the fight must be begun over again or abandoned.

It is a grave mistake so to watch over the patient that he feels he need no longer consider whether an act is "right or wrong" for him. This weakening of self-control may result disastrously when the patient returns to his former surroundings and is in a certain sense one of the objections to sanatoriums and a great advantage of home treatment. It requires more self-control at the outset to carry out the hygienic-dietetic treatment alone and in this particular the sanatorium offers great advantages and often what at first is irksome and unpleasant becomes later indispensable to comfort when once ingrained habits of hygienic living are formed. Such habits are more easily and pleasantly acquired at a sanatorium.

During his residence at the sanatorium the patient should be encouraged to seek information from the proper authorities and great pains should be taken to explain fully the reason of each rule. Strict rules about being out of doors, rest, exercise, visiting between sexes, smoking, reception of visitors, hours of retiring, the use of stimulants, the care of the sputum, and the conduct in general of patients one toward another are very necessary, but should be as few and as simple as possible. Smoking at stated intervals for selected patients may be indulged in but only out of doors. Inhalation of the smoke should be forbidden. All patients should be required to be in bed with lights out at from 9 to 10 P.M. Visiting between sexes should be permitted in a cottage sanatorium only during the afternoon from 3.30 to 5 P.M., never under any circumstances in the bed room.

The daily routine should be something as follows: Awake 7 to 7.30 A.M. and at once take temperature before arising. Cold bath or sponge. Breakfast 8 A.M. Out of doors at 8.30 to 8.45 A.M. Rest in chair until 10 to 11 A.M. Exercise. Rest in chair 12 to 1. Dinner 1 P.M. Rest (siesta, no conversation) 2 to 4 P.M. Exercise. Rest 5 to 6. Supper 6 P.M. Retire 9 P.M. All resting should take place out of doors on a long chair or on a bed. Between supper and 9 P.M. the patient may be allowed to write a few letters, engage in non-exciting games and converse or listen to lectures or music. Later exercise should replace some of the time devoted to rest and many individual changes must always be planned for.

*Visitors.*—Except the immediate members of his family it is unwise for a patient, especially at first, to see many visitors. In most instances it is a matter of considerable importance to have some member of the patient's family visit him at some time during his residence for by this means the ordering of his life when he returns home is greatly facilitated. No one suffering from cold or influenza should be allowed upon the sanatorium grounds.

*Classes, Work, Amusements.*—In all sanatoria the time passes slowly for many patients, and every opportunity to encourage idleness is afforded. This tendency should be strongly combatted by suitable work, classes or amusements. A good library with the current magazines, and a piano for those patients who are allowed to play are important. A veranda should be attached to the library. A well ventilated dark room, such as that designed by Mercer at the Adirondack Cottage Sanitarium and instruction in photography are helpful. Sketching is also useful but nature study is far more valuable than any of these. To arouse or instill a love of birds, flowers, geology or some kindred subject, an interest which the patient will carry with him through life wherever he goes is of extreme value. Every patient if possible should leave the sanatorium with an outdoor hobby. For many, however, nature study has no charms and for these patients arts and crafts of wide variety should be provided. At several sanatoria this has already been done and the open-air workshop at the Adirondack Cottage Sanitarium, established some years ago, teaches the patients book-binding, illuminating in the manner of the monks of old, wood

carving, photography, picture framing, stenography, telegraphy, and typewriting. The patients are deeply interested, and many are enabled to earn one half of their expenses while at the Sanitarium. Competent and inspiring teachers are necessary, teachers who are also familiar with the psychology of the man who has but newly realized the position he must now occupy.

Lectures should be given at intervals upon hygiene, and any subject of interest.

*Work for Patients.*—Suitable useful work at the sanitarium is a great mental relief to many patients who envy the man who is allowed to do most. It also fits many to return to their former occupations which, alas! must frequently take place. It is, however, not easy to introduce work among patients unless it is made obligatory and patients informed of it beforehand as King, Rosenberg and others have noted. It is further of great advantage in showing the patient what he can or cannot endure, often aids in overcoming a spirit of idleness and clearly indicates what patients are "work-shy."

Work at a sanatorium depends much upon the class of patients accepted. The laboring man who has used his muscles can safely attempt work which would be injurious to the clerk or stenographer. Many charitable or semi-charitable sanatoria require all patients to do some work, which however should be done leisurely and never under tension. For men this is usually some form of gardening but at the White Haven Sanatorium under Flick the patients (men and women) have long done practically the entire work of the institution. If a patient at the end of four to six weeks is not able to work one hour a day he is discharged from the institution or transferred to "Department No. 2," where patients who pay \$7 a week may remain at rest an indefinite period.

At the Brompton Hospital Sanatorium, Paterson has gradually increased the exercise of patients, who first walk, then pick up pine cones and fagots and carry them in baskets weighing in all 11 pounds to the stack. Carrying heavier baskets of gravel, pulling a lawn roller, digging broken ground, and pushing a lawn mower are then permitted in turn. No workingman is said to be arrested until he can handle pick and shovel for six hours a day without

**FIG. 9.**



**OUTDOOR WORKSHOP  
Adirondack Cottage Sanitarium**



increase of pulse and temperature other than normal, and maintain his weight on an ordinary diet. Excellent results have been obtained. In many German sanatoriums the poorer patients refuse to work.

Work for women is more difficult and should include housework, lace making, darning, picking up litter, etc. Window-cleaning, polishing brass work, clerical work, rough painting, cleaning harness, and much other light work may be done by patients.

It must not be expected, however, that such work will necessarily lessen the expenses of the sanatorium, for many patients must be taught, and it is often easier to do the work than to have to see that it is properly done by patients. It should, however, be looked upon as an important part of the treatment and the number of healthy men necessary to do the work may be reduced.

At the Kelling Sanatorium a few patients are allowed to remain on for some months when they desire to remain to work. They receive \$0.50 a week for five hours' daily work, \$0.90 for 7 hours and \$1.25 for full work.

It is needless to say that patients at work need very careful medical supervision and malingerers often have to be overlooked for fear of injuring an honest patient. Ample time for rest should be afforded and Luard obtains excellent results with a half holiday on Wednesday and Saturday. (See Bardswell, *The Consumptive Workingman*.)

*Length of Stay.*—The length of stay in a sanatorium, varying from three months in the insurance sanatoriums of Germany to three years in some private institutions, depends directly upon the object that the sanatorium wishes to attain. No permanent improvement can be expected by treatment of less than three months' duration, and in fact the sanatorium should be looked upon more as a university. It should indeed be a university of health where patients are given different courses, some required and others elected, but all should have instilled into them such rules for hygienic living that when they leave they will be able like university students in other lines to think and act "hygienically" under all and even the most adverse conditions. Few sanatoriums are able to keep patients until they are permanently

cured, and in fact few patients are financially able to remain a sufficient length of time, for the cure of any but the veriest incipient case, requires at least two or three and in most instances four or five years. The greater part of this time, however, can be spent at home and in suitable work. This should be made clear to every patient and he should be told that if he return to work he can do but two things, work and take care of himself—he cannot play also. It is very difficult to decide how soon a patient can leave a sanatorium when he is depending upon his own efforts for a livelihood. Occasional attacks of fever, a persistently rapid pulse and fatigue after slight exercise, all indicate that the patient's position is still very insecure. On the contrary if he can work or take considerable exercise, if he need no longer a forced diet to maintain his health, or if he has been without any symptoms for three or four months, he may consider returning to his home, and within a few months resuming some suitable occupation.

A coöperative employment bureau is difficult to maintain effectually as most employers refuse to engage anyone who has or has suffered from pulmonary tuberculosis.

*Modification of the Sanatorium.*—Many modifications of the sanatorium have been devised to meet special needs. It has long been recognized that a large number of patients must remain at home, usually in crowded quarters of the great cities and many schemes have been employed to aid these. Day sanatoriums, including the "classes" of Pratt, the camps of the Boston Anti-tuberculosis Association, where patients are instructed and given facilities for pursuing the hygienic-dietetic treatment have all met with great success. The night sanatorium where patients who must work can sleep out of doors is another valuable addition.

Agricultural colonies have been founded to aid in the post-discharge treatment but much farm-work is ill adapted to pulmonary convalescents and the success attained has not been great. The family colony, where a patient may live and work with his family has also been suggested. So far none of these schemes has been able to be self-supporting.

Elaborate plans and descriptions of a ship sanatorium have been published but the success of such a venture is not yet assured.

A sanatorium on wheels, a bullock cart, is said to have proved expensive but successful in South Africa. Special sanatoriums at the seaside for "surgical" tuberculosis in children have been successful. Separate sanatoriums for pregnant women have also been advocated.

A matter of no small importance is the care of the patient's family while he is undergoing sanatorium treatment. It is useless to expect any patient to improve who is daily worried about his family. This problem, however, does not belong to the sanatorium but must be solved by the charitable organizations at the patient's home.



## NOTES ON THE TREATMENT OF SYPHILIS BY THE INJECTION OF SOLUBLE SALTS OF MERCURY

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THE choice of the method of administering mercury and its salts in the treatment of syphilis will naturally depend in great measure upon individual circumstances. Although every practitioner will have a bias in favor of the particular method with which he has become familiar, there are circumstances and conditions from the point of view of the patient which militate in favor of the use of certain pharmaceutical forms in preference to others. I do not propose to discuss the subject as a whole on the present occasion, because this would take me too far afield; so I shall content myself with pointing out the reasons that appear to me to indicate the desirability of employing soluble salts in certain cases, and describing the technique of the procedure.

It may be premised that there are three methods of introducing mercury into the organism: (1) by the mouth, (2) by inunction, and (3) by intra-muscular injection. The administration of mercury by the mouth is open to grave objections. To begin with, most salts of mercury exert an irritating effect on the gastric mucosa and as, incidentally, they stimulate the intestinal functions their energy is apt to be wasted in setting up diarrhoea, in which event very little is absorbed by the organism. It follows that the practitioner can never know for certain what proportion of the drug is being organically employed. Moreover mercury given in this way is slow to act so that in urgent cases the method is absolutely contraindicated. Inunction, which depends for its success upon the absorptive functions of the skin, is even less trustworthy. The absorptive powers of the skin vary within very wide limits, and under the most favorable circumstances are slow and uncertain. Then, too, we can exercise very little control over the quantity of mercury passing into the organism, and in the event of symptoms of intoxication super-

vening we are disarmed; for the effect goes on increasing even for several days after suspension of the treatment. These are such serious drawbacks that inunction, once the prevailing method of administering mercury, is now rapidly falling into disuse. The method of injecting salts of mercury is in great measure free from the objections just referred to although it admittedly entails sundry objectionable features of its own. My object on the present occasion is to point out how these may be obviated or overcome in order to facilitate recourse to this, the truly logical and scientific method, based on recent experience. It enables us to give the drug with absolute precision, and yields incomparably more striking results. Treatment by injections is rapid yet lasting, the therapeutical effects are produced easily, and when skilfully carried out the method is practically devoid of danger.

For purposes of injections we may choose between the *soluble* and the *insoluble* salts. Both have their advocates, and each presents certain special advantages and certain drawbacks. It cannot properly be asserted that either is superior to the other because the choice should be made for valid reasons based on clinical experience, and not on any *a priori* considerations.

Among other circumstances that will guide us in selecting the particular salt to be employed will be (1) the social and financial position of the patient. If he can afford the time and cost of the more frequently repeated injections of soluble salts, these are to be preferred because they enable us to keep in touch with the patient, and to direct the treatment with greater nicety. When, on account of his living at a distance or by reason of the nature of his occupation, the patient is unable to attend with the necessary frequency, we are fain to have recourse to the insoluble salts, the action whereof is slower; and although their action cannot be so well controlled as that of the soluble salts, they are nevertheless therapeutically active.

Then, too, we must take cognizance of the pathological condition. It is evident that when we have to deal with some grave manifestation of the disease—affecting the eye, the throat, &c., it behooves us to employ the treatment which will act most promptly, and under these circumstances no hesitation is possible in deciding in favor of the injection of a soluble salt of mercury. For this reason I

have selected the injection of soluble salts as the subject of my remarks.

I have already pointed out the advantages presented by the injection of soluble salts, *viz.*: the practitioner knows exactly what dose of the drug is undergoing absorption, the characteristic effects are rapidly induced, the digestive functions are not disturbed, an all-important point in many instances, and, lastly, the therapeutical effects can be calculated with almost mathematical accuracy.

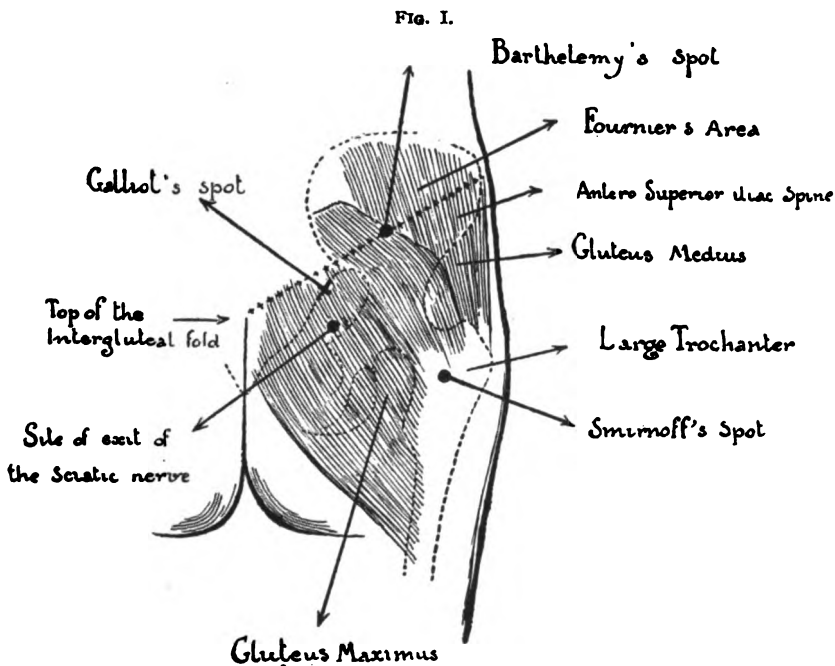
The drawbacks of the method are the pain that is apt to follow the injection coupled with the possibility of abscess formation. So far as the pain is concerned it is a very variable element. Much depends on the nervous constitution of the patient, although it must be conceded that the choice of the site and the manner of making the injection are not devoid of importance from this point of view. Certain it is that beginners or persons unfamiliar with the procedure cause much more pain than those in the habit of practising the method. I shall refer to this later on in dealing with the technique. The formation of abscess constitutes a reproach for the operator since it is well established that this may be altogether avoided by proper aseptic precautions. Similarly, there exists a theoretical risk of causing embolism, but this, for all practical purposes, only applies to the injection of salts dissolved in an oily vehicle; moreover it is quite easy to make sure that the needle is not pointing in a blood vessel, and if this possibility be discarded that of embolism disappears. As a matter of fact if, after introducing the needle, the syringe be detached for a few seconds, communication with a blood vessel will be indicated by the escape of blood and when this does not take place the injection may safely be proceeded with.

The apprehensions that have been expressed lest these injections should give rise to neuritis or paralysis do not appear to be founded on clinical observation. Of course if the injection be made into a nerve trunk trouble will not improbably be caused, but even an elementary knowledge of anatomy will suffice to render such an occurrence impossible. In any event such accidents are of the rarest and need not detain us further. To sum up, the risks peculiar to this method of treatment are all readily avoidable, and most of them, to put it plainly, are the outcome of negligence on the part of

the operator. I have never met with any complication of the kind in the course of ten years' experience, which shows at any rate that harm *can* be avoided, and if it can be avoided it ought to be avoided.

Without entering into the consideration of the probable influence of these salts on the organism, which would serve no useful purpose, I will now proceed to describe the technique of the procedure.

The best syringe for the purpose is one constructed wholly of glass, partly because it can be more readily sterilized, and partly also



because there are no metal fittings liable to be corroded by the mercury. The needle, which may be of steel or irideo-platinum, must be at least 5 cm. in length (7 cm. for stout patients) in order to penetrate deeply into the muscle mass. It is always well to have several needles at hand in view of possible blockage or breakage. It should be borne in mind that steel needles soon become brittle so that they must not be used more than once or twice. It is highly important to use only sharp pointed needles. To use a blunt needle from

motives of economy is to inflict a vast amount of unnecessary pain, a fact which does not escape the attention of the patient who soon makes a mental and verbal note of the advantage attending the use of a new needle.

*Site of Injection.*—As a rule the injection should be made into the body of the muscle. Intra-venous injection has been suggested, and indeed practised, but it is more difficult, is attended by obvious risks and gives results in no respect superior to the intra-muscular plan. The site of election is the gluteal region which offers several eligible spots as indicated on the accompanying diagram (Fig. I). A spot midway on a line between the top of the inter-gluteal gutter and the antero-superior iliac spine, known as Barthélemy's point, is that usually chosen (Fig. I). It is at a safe distance from the sciatic nerves and vessels, and, moreover, its situation does not entail any inconvenience when the patient sits down. In women on the other hand the injection must not be made too high up, for in this case the puncture may be impinged upon by the corset. The injections are made alternatively on the right and left sides on the same line though not on the same spot.

*The Injection.*—The skin over the spot to be injected is rendered aseptic by washing with soap and water, rubbing with rectified spirit or Eau de Cologne, and finally cleansing with a 1 in 1000 solution of perchloride of mercury. The syringe having been boiled and the needle flamed, the next step is to pinch the muscle sharply. The needle is then plunged through the skin right into the muscle at a suitable depth (which varies according to the thickness of the subcutaneous layer of adipose tissue), taking care to grasp the needle between the thumb and index finger at the point where it is fixed to the syringe nozzle. The needle must be held perpendicularly when inserting, otherwise it may snap off under the strain, especially when a steel needle is used, giving rise to an awkward accident which is by no means of rare occurrence. The injection may be made at once, or better, the syringe may be detached, and a few seconds allowed to elapse so that one may see whether any blood comes away. If blood comes, this would indicate that a blood vessel had been entered, in which case the needle should be withdrawn half an inch or so and pointed in some other direction. The injection must be made slowly in order to

damage the tissues as little as possible. The injection having been completed, the needle is withdrawn and the spot touched with collodion. Gentle massage will help to relieve any smarting that may be complained of.

Before proceeding to inject, certain precautions are indispensable. To begin with, we must make sure that the patient's kidneys are in good working order, and this will be shown by a complete analysis of the urine as regard to presence of albumen, sugar, phosphates and chlorides. Any marked diminution in the proportion of chlorides should excite suspicion. The next step is to ascertain the condition of the patient's mouth. Decayed teeth should be removed or dressed, and he should be instructed to clean the teeth twice daily, morning and evening, with a mouth-wash containing tincture of myrrh and borax or other suitable mildly aseptic and astringent dentifrice.

The dose to be administered and the frequency with which it is to be given must be regulated according to the susceptibility of the patient and the urgency of the treatment, *i.e.*, the rapidity with which the therapeutical effects are desired. The dose will also vary according to the particular salt selected. It is always wise to commence with small doses which can be steadily increased according to circumstances.

*The Choice of the Soluble Salt.*—The points to be considered in selecting a soluble salt are the following: First of all the salt should be a well-defined chemical compound, it should be stable and keep well in solution. It must be soluble in water since this is the vehicle to be preferred on account of its unirritating qualities. The salt should be one that does not precipitate in the organic fluids and the less toxic it is the better. It must not be caustic or it will cause unnecessary pain, conduce to abscess formation or leave behind it an undue amount of induration. I insist on the solubility of the salt in water because I deliberately discard oily solutions.

A large number of soluble salts are available for purposes of injection. Some authorities hold that the efficacy of a mercurial salt depends solely on its richness in the metal, and within certain limits of course this view is correct. In considering the value of the various compounds we must assuredly take into account the proportion of mercury they contain, but their richness in metal

is not the only factor to be weighed. For instance, a salt comparatively rich in mercury may be unduly irritating to the tissues so that its injection is followed by intolerable pain. On the other hand, a salt less rich in mercury may be comparatively unirritating and so allow of our increasing the dose in such wise that it may be possible to introduce more mercury by the weaker salt than would be practicable with the more powerful, and more irritating, compound. In short, the best salt is the one which is best borne. Clinical experience alone will teach us which is the compound best adapted for the purpose in individual cases.

*Benzoate of Mercury*, which is readily soluble, may be employed in the following solution:

R

Benzoate of Mercury.....	1 gm .
Chloride of Sodium .....	2 gm 50
Distilled Water .....	100 cc

Each cubic centimetre contains 1 centigramme of the salt which is equivalent to 0.0045 gm. of the metal. This solution is comparatively unirritating and is well borne. It gives rise to but little inflammatory reaction and only causes slight smarting. The average dose is from 1 to 2 centigrammes.

*Biniiodide of Mercury* is a popular agent employed in the form of the following solution:

R

Biniiodide of Mercury.....	0.20 grams
Pure Iodide of Potassium...	0.20 "
Distilled Water .....	10.0 "

This salt exerts very powerful therapeutical effects and gives good results, but its administration by injection is somewhat more painful than the benzoate. Dose 1 to 2 centigrammes.

*Salicylate of Mercury*.—The solution is prepared with chloride of sodium: R

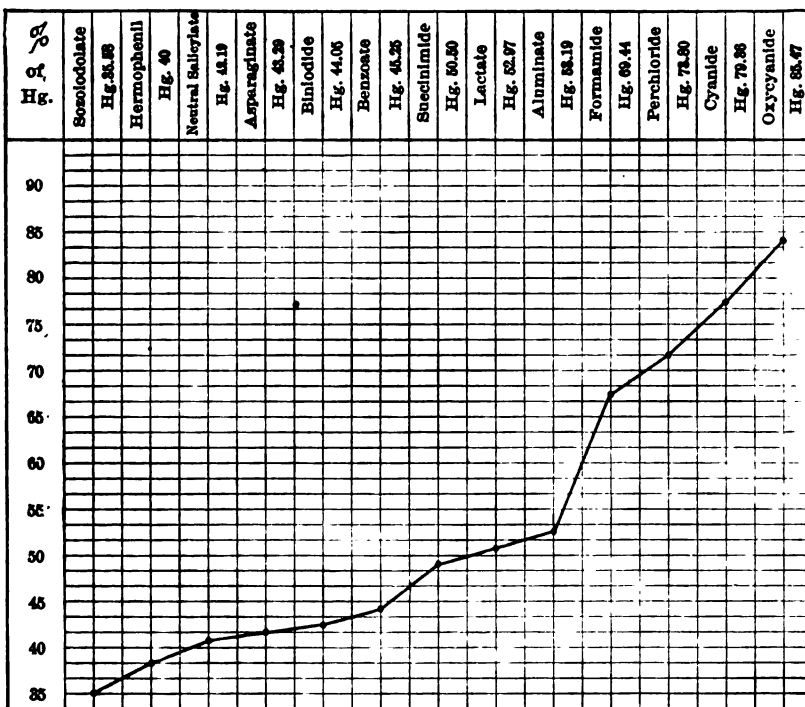
Salicylate of Mercury.....	0.20 grams
Chloride of Sodium.....	0.75 "
Distilled Water .....	10.0 "

Each cubic centimetre of this solution contains 0.0084 gm. of the salt. It is a standard formula which is very active. The pain caused by the injection is variable. Average dose 2 centigrammes.

*Hermophenyl*.—This is a less active product but injections with it have the advantage of being practically devoid of pain. The dose is from 2 to 4 centigrammes, to be injected daily.

*Cyanide of Mercury*.—This salt is especially rich in mercury, and possibly on this account is not well tolerated. It is apt to cause stomatitis and diarrhoea, and the injection is distinctly painful, moreover the salt is very toxic. The dose is from 1 to 2 centigrammes.

FIG. II.



PROPORTION OF MERCURY IN THE VARIOUS SOLUBLE SALTS

*The Oxycyanide of Mercury*, also very rich in mercury, is open to the same objections as the cyanide, but the oxycyanide is less toxic than the former. The average dose is 2 centigrammes.

*Succinimide of Mercury*.—This is well borne but its therapeutical action is comparatively weak.

*Lactate of Mercury*.—This salt is well borne, and its injection



is not very painful. It gives good results in doses of 3 centigrammes daily.

I have arranged these various salts in what appears to me to be the order of their importance, and personally I have quite abandoned the use of the more highly toxic compounds (Fig. II).

I have already pointed out that the choice of a salt cannot properly be made on any *a priori* consideration since each patient has his idiosyncrasy. Some react well to the benzoate, for example, while in others this salt causes pain or induration. At the outset it is well to try first one and then the other until we find which is best borne and which gives the most satisfactory results.

In conclusion I would insist on the fact that the method of injecting soluble salts is never likely to become the routine treatment of syphilis. Nevertheless in grave or urgent cases, as well as in patients who do not improve under ordinary methods, the employment of the soluble salts constitutes a sure and safe means of applying a rational and strictly scientific treatment.

(1) It enables us to graduate the dose of mercury with absolute precision, inasmuch as the practitioner knows exactly what quantity of the metal is being introduced. There is consequently no "margin of error." (2) Thus administered the organism exhibits remarkable tolerance for the drug, the full benefit whereof is thus available. When carefully but skilfully handled the method entails no risk of complications, but any want of care may have serious consequences.

## SOME CLINICAL ASPECTS OF BLOOD COAGULATION\*

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THE phenomena of blood coagulation has attracted the attention of physicians from the earliest times. Hippocrates and his immediate followers supposed that coagulation was due to loss of heat and closely analogous to the freezing of water. The Humoral pathologists, however, ascribed the clotting to internal changes in the blood as it progressed toward death and disintegration; thus approaching in a measure the present chemical theories. They also made minute diagnostic inferences from the quantity, color, and consistence of the clots, which were supposed to reflect the condition of the bodily humors.

With the passing of venesection as a common therapeutic measure, the clinical interest in coagulation phenomena waned to the disappearing point, and it is only recently that it has again begun to attract some measure of attention. In the last fifty years numberless scientific researches have been made into the nature of the process and several distinct schools advocating as many, often widely divergent, theories of coagulation have arisen among the physiologists and chemists.

The details of these do not especially concern us at the present moment, and it will suffice for our needs if we accept as a working basis a simple outline of the fermentation hypothesis favored by the majority.<sup>1</sup>

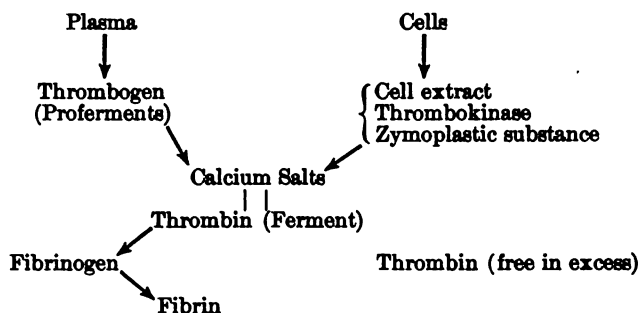
In accordance with this schema we have in the circulating blood fibrinogen, proferments (thrombogen) and calcium salts. In the cells of the tissues and of the blood we have some substance which acts on the proferments causing them to combine with calcium salts to form fibrin ferment or thrombin, this in turn acts upon the fibrinogen with the ultimate precipitation of fibrin.

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\* Read before College of Physicians of Philadelphia, December 9, 1907.

<sup>1</sup> Morawitz. *Ergebnisse der Physiol.*, 1905. Bd. 4. i-ii abt. for literature and general discussion.

Calcium salts are essential to the formation of fibrin ferment, but this latter may change fibrinogen to fibrin in the absence of free calcium although the presence of calcium in moderate concentration increases the rapidity of the reaction and the firmness of the clot.



Experimentally various means are at our disposal for preventing the coagulation *in vitro*. Among these may be mentioned:

I. Physical agencies. As receiving the blood in paraffined vessels and preventing its contact with tissue or foreign bodies. This probably acts by inhibiting the formation of the activating substance. Or we may cool the blood rapidly to a low temperature with the same result.

II. Chemical agencies. 1. Addition of neutral salts, as magnesium sulphate or sodium chloride in sufficient amount. These salts probably act by their concentration which prevents disintegration of cells, and the plasma coagulates spontaneously on simple dilution with water or blood. 2. The change of calcium from soluble to insoluble condition, as in oxalate, fluoride, or citrate plasma. These will coagulate on addition of soluble calcium salts, or excess of active ferment.

III. Indirectly through a specific tissue reaction; as injections of peptone, cell extracts, autolytic products and foreign sera.

IV. With leech extract which is active *in vitro* as *in vivo*.

V. Injection or mixture with large amounts of bile.

VI. Large doses of alcohol reduce, but do not destroy, coagulability.

The coagulability may be increased by addition of calcium salts in moderate amount, and to a less degree, of magnesium,

barium, and strontium salts, or by the injection of certain nucleoproteids, or tissue extracts, and by the inhalation of carbon dioxide.

Turning from theoretical considerations, let us inquire if the study of the coagulation has any practical bearing on the diagnosis and treatment of disease.

To make such studies we must have first of all a clinically applicable method for measuring the coagulation time which is simple enough to be easily acquired, and, at the same time, capable of giving constant results. All the procedures for the measurement must needs be empiric to a certain extent, as the blood is examined after removal from the vessels.

Of the various methods described, I shall consider in detail only the one which has seemed to me the best, and refer to the literature for comparative studies and descriptions.<sup>2</sup>

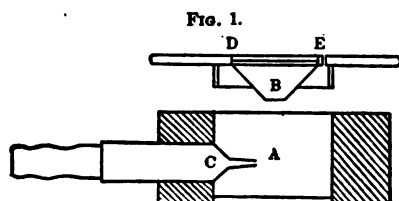


FIG. 1.  
Coagulometer of Brodie and Russell as modified by Boggs. A, moist chamber; B, cone of glass, the lower surface of which holds the drop of blood; C, side tube; D and E, cover-glass; at E, a pinhole.

This method is that described by Brodie and Russell,<sup>3</sup> the principle of which is that if a drop of blood in a suitable moist chamber be set in rotation by a very fine stream of air tangentially directed, we may detect with the microscope the progress of coagulation by observing the changes in the movement of the red blood corpuscles.

A simplified and improved Brodie-Russell coagulometer is the instrument I have employed most satisfactorily. In the use of this apparatus it is essential to observe certain points of technic. (1). The blood must be obtained from a free flowing puncture. When a large drop has formed, the cone (B) is touched to it at

<sup>2</sup> Hinman and Sladen. *Johns Hopkins Bull.*, 1907. Vol. xviii, pp. 207-220, for comparative study of methods with bibliography.

<sup>3</sup> Brodie & Russell. *Journal of Physiol.*, 1897. Vol. xxi, p. 403.

right angles to the surface of the drop and not dipped in. In this way a drop of constant size is obtained. (2). The progress of coagulation is tested from time to time with a very gentle blast of air until the radial elastic motion is observed, as of a rubber ball pressed in at one point and released. (See diagram (D) Fig. 2.) This is the end point. It should be confirmed by wiping off the blood with a piece of filter paper when a fibrin mass will be seen. (3). The coagulation time is counted from the moment the blood appears at the surface of the wound until this end point, above described, is reached. (4). Absolute cleanliness of the apparatus

FIG. 2.

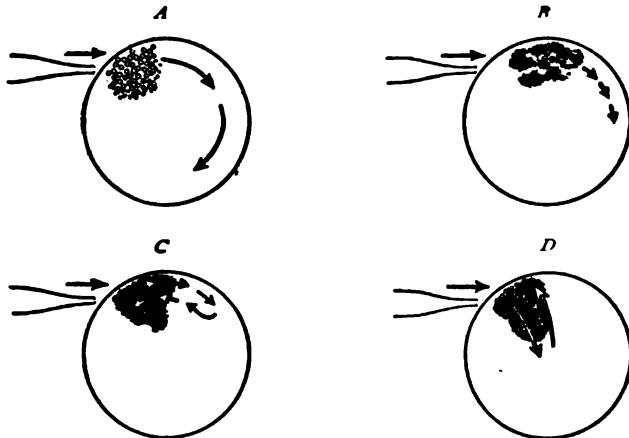


Diagram to illustrate the movement of the cells during coagulation.

is essential. (5). Pressure upon the tissues or congestion of the parts will increase the coagulability of the blood.

The therapeutic measures for influencing the coagulability of the blood <sup>4, 5</sup> are, in the present state of our knowledge, rather limited, but it is to be hoped that more careful experimental study and clinical observation may extend the usefulness of those we now have and bring to light others.

For increasing the coagulability of the blood, the salts of calcium are our most valuable agents. Of these the lactate and acetate are to be preferred to the chloride on account of the irritant qualities and nauseous taste of the latter. They may be exhibited

<sup>4</sup>Wright. *British Med. Journ.*, 1894. ii, p. 57, and many other papers.

<sup>5</sup>Boggs. *Deutsches Archiv f. klin. Med.*, 1904. xxix, pp. 539-550.

by the mouth, subcutaneously, or intravenously, according to the needs of the case. When given by the mouth 3 or 4 grams of the lactate in twenty-four hours will usually serve to produce the maximum effect. This is evanescent, and, if a continued influence is to be exerted, the dose must be increased in steps, or the drug discontinued for three or four days as soon as the effect begins to wear off. After this calcium-free interval the original small dose will produce its full effect again. Or large doses of 3 or 4 grams may be given at intervals of two or four days, according as the excretion and loss of effect is more or less rapid.

Magnesium and strontium may sometimes exert a similar though less striking influence on the coagulability when given by mouth. For injection or transfusion a 1 per cent. to 2 per cent. solution of calcium acetate in physiological salt solution should be employed. The acetate should be made slightly alkaline by oversaturating with calcium carbonate, the hot solution, and then filtering off from the excess. In this way it may be safely injected beneath the skin, or intraperitoneally. This alkaline acetate solution is also the best for transfusions.

A solution of the chloride in salt solution has been freely introduced into the veins of animals without the least difficulty or untoward result. I have given rabbits in this way 50 c.c. of 1 per cent. solution, or 10 c.c. of 5 per cent. solution without producing any intervascular clotting, and without the slightest evidence of cardiac embarrassment.

It is, at first, hard to reconcile the experience of physiologists with regard to the poisonous effect of small amounts of calcium salts on the heart, with the fact that patients have been given as much as 5 grams at one subcutaneous infusion without any observable influence on the heart in rate or force. It is probably due, however, to the fact that the percentage of calcium in the whole blood is but slightly increased as contrasted to the effect of direct perfusion of the heart as practiced by physiologists.

It has been shown<sup>\*</sup> that *in vitro* a great excess of calcium salts may delay or entirely prevent the coagulation of the blood. This effect seems to depend upon the concentration of the calcium as in other salted plasmas, and is lost upon dilution. The concentration

<sup>\*</sup> Fleig et Lefébure. *Journ. de Physiol.*, 1902. Tome, iv., p. 615.

necessary to produce this effect is from 1.5 per cent. to 3 per cent., varying with species and individuals. It is held by Wright that large doses of calcium salts will produce this effect in men, but in our experience we have not been convinced that this is generally true. Experimentally it is possible to increase the calcium content of the blood by administering the salts, but no such concentration is reached as that indicated above.

Of other agents capable of increasing the coagulability of the blood, none is so generally useful or so safe as calcium. The inhalation of carbon dioxide has a marked though very evanescent effect, as shown by Wright and others. This procedure might be of value in emergencies where other means were contraindicated or not available. The intravenous injection of "tissue extracts," "cell fibrinogen," or "nucleoproteid" would not be justifiable in the present state of uncertainty as to the laws governing their action.

Sahli has pointed out that hæmophilic individuals show less tendency to bleed if kept in a high state of nutrition on a mixed diet.

From an extended experimental and practical experience with gelatine injections we feel that it is too unreliable to be of any value as a coagulant. Its activity is probably due to the content of calcium and its administration is distressing to the patient and the results are not nearly so marked as with calcium salts alone.

It is not often that efforts directed toward the lessening of the coagulability are indicated, but in cases with a marked tendency to thrombosis, citric acid may be tried as advised by Wright,<sup>7</sup> or an acid forming non-carbohydrate diet, as in the case reported by Thayer and Hazen,<sup>8</sup> or the administration of alcohol as shown by Vierordt and by Wright if it were not otherwise contraindicated.

Having considered the means of measuring the coagulability of the blood and the agents at our disposal for modifying it, we may conclude with a brief review of the application of these agents to special cases. For this purpose we will divide them into two groups: A. Those with decreased coagulability. B. Those with increased coagulability.

The first class includes many cases of excessive hæmorrhage

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<sup>7</sup> Wright, *loc. cit.*

<sup>8</sup> Thayer & Hazen. *Journ. Exp. Med.*, 1907, vol. ix.

after trauma, operative or accidental, bleeding from ulcers and erosions, capillary hæmorrhage, etc., as well as the hæmorrhagic diatheses, jaundice, acid intoxications, serous effusions and certain skin diseases.

It should, however, be kept in mind that not all cases of any one group will show this delay in coagulation, with the exception of hæmophilics, and even they may show a normal coagulability at times. And it must also be remembered that given a delayed coagulation time, this may be due to one of several different changes in the blood or tissues, and may not respond to therapeutic measures directed to the increase in one coagulative factor only. No matter what theory of coagulation we accept this clinical fact is constantly emphasized, that not all cases of the same disease will show the same change in coagulability, nor even when it is present, give the same response to treatment.

Where hæmorrhage is from a vessel of any size, none of these coagulants can be expected to have much influence. Thus Brown failed to secure any satisfactory results in the treatment of pulmonary hæmorrhage with calcium salts. The same would be true of active hæmorrhage from gastric ulcer or from typhoid erosions. But where the bleeding is from the very small vessels or capillaries, we may hope to assist the natural process of clotting in many instances.

Of cases of excessive hæmorrhage after trauma, we have seen but few, and in these excellent results were obtained in most by the exhibition of calcium salts. In cases of vesical carcinoma and a few other bleeding carcinomata of the uterus and stomach, complete cessation of hæmorrhage has been attained by properly regulated dosage with this salt. Several cases of purpura have given most satisfactory results, it being possible to check bleeding and effusion into joints by careful observation and treatment.

In hæmophilia the effect of calcium therapy is marked as a palliative measure as first shown by Wright. In several cases under our observation the results have been equally good. It would seem desirable that such patients take calcium salts regularly, either in large doses every three or four days or in small doses with intervals between treatments.

With jaundiced cases the results have been less uniform. As



reported by Sladen and Hinman, we have found many cases with a normal time, principally cases of catarrhal jaundice.

In cholelithiasis the icterus is usually more marked and the coagulability decreased. While with obstructive jaundice, due to malignant tumors, we have found the greatest decrease. The difference is not absolutely constant, however, and although most of the cases respond to calcium therapy, some do not; it must be tested in each, individually. Where there is no response to calcium salts, it might be well to try magnesium or strontium. The cause of the delayed time in icterus is not certain. It may be due to the presence of bile acids in the blood, or to the action of the protein constituents of the bile. We hope at another time to report some experimental observations on this point.

In two instances of hæmorrhagic effusion into the joints and between the muscles in pernicious anæmia, we were able to control the bleeding by subcutaneous infusion of calcium. Here immediate measures were imperative on account of the patient's condition.

Other cases with favorable result include certain hæmaturias, two tuberculous kidneys, epistaxis, gastric ulcer, etc.

With regard to the treatment of aneurysm by increasing the coagulability of the blood, we have never had any encouraging result. It is possible to increase the coagulability, but we have never observed any change in the aneurysm from the increase. These cases have, so far as our records go, a normal time. Calcium should be administered, however, before and after wiring an aneurysm.

In scurvy, Wright reports good results from calcium therapy, and in cases of serous effusion, associated with decreased coagulability. We have had, however, no sufficient observations to warrant an opinion.

The type of headache described by Ross<sup>\*</sup> as due to lowered coagulability and consequent changes in intracranial tension, has never come under our observation.

In a few skin diseases we have had some rather interesting results. A stout young woman had suffered for several years with axillary hyperhidrosis and eczema whenever she wore dress

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<sup>\*</sup> Ross. *Lancet*, London, 1906, vol. i, p. 143.

shields or heavy clothing. Constitutional and local treatment by dermatologists was unavailing, and she was obliged to wear light summer dresses all winter. An examination of her blood showed a decreased coagulability, and the use of repeated small doses of calcium lactate whenever she wore heavy clothing has kept her free from serious trouble.

Several cases of severe urticaria, without any assignable etiology, responded promptly to the same treatment. Others gave no result. Wright reports cures in cases following the ingestion of strawberries, etc., and after diphtheria antitoxin. In several instances hyperhidrosis of the feet has been promptly relieved by this treatment. With the treatment of chilblains, our experience has been limited, and in none of our cases were we able to show a lowered coagulability or to get any improvement from the exhibition of calcium as advocated by Wright and his pupils.

As regards the treatment of thrombosis by reducing the coagulability through the exhibition of citric acid as advised by Wright and Knapp, especially in typhoid fever, we have been unable to detect any marked increase in the coagulability in such cases, nor have we seen any difference in the incidence of this complication in the cases given a mixed diet as compared to those fed exclusively on milk which is rich in calcium.

From the foregoing, it seems evident that there is a field for the clinical study of the coagulation of the blood, and a possibility of valuable therapeutic results which will increase in proportion to the care and frequency with which these studies are made.

## **SOME RECORDS OF THE VALUE OF THE OPSONIC TEST FOR DIAGNOSIS, AND OF THE EMPLOYMENT OF VACCINES IN CERTAIN INFECTIVE CONDITIONS IN CHILDREN**

**BY A. DINGWALL FORDYCE, M.D., F.R.C.P., ED.**

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OF recently introduced methods in clinical pathology and of recently propounded theories, few have aroused more general interest and speculation, in this country if not elsewhere, and none have disclosed more alluring prospects of successful results than the theories and method of Sir A. E. Wright.

Accepting for the moment his doctrinal theories, by means of this method we find ourselves confronting the very fount of disease, we are in a position to gauge the comparative virulence of infection with the power of response and we are encouraged once more to believe that in the course of time our extremely serviceable but eminently untrustworthy servants, drugs, will be very largely superseded and wholly relegated to the important but subordinate service of counteracting pressing symptoms, while by means of vaccines and anti-toxic sera the root of the evil is directly attacked.

Certainly a hopeful prospect and worthy of the fullest study, but like all pictures naturally concealing a reverse side. Into the subject of the nature of opsonin I have no intention to go. But whatever its nature be, whether it corresponds to complement or whether it does not, whether thermostable and thermo-labile opsonins be distinct classes of substances or not, such a substance as opsonin exists and is measurable. With what degree of accuracy this measure can be taken is a subject of more immediate interest. The technique of the opsonin test is simple, extremely simple, but even for the attainment of an approximate degree of accuracy necessitates considerable practice, more or less constant employment and the most painstaking care from commencement to finish of the process.

At best such a comparatively lengthy method as this is, permitting as it does of so many possible sources of error, must give not altogether accurate results.

Where, however, the three conditions mentioned—practice, constant employment, and marked care—are fulfilled the test is one I think with a margin of error so small as to be of the greatest possible value in connection with clinical work.

And in saying this and after emphasizing once more that only with the most painstaking care in matters of detail can satisfactory results be obtained, there are one or two points on which I should like briefly to touch.

Wright and Douglas (*Proceedings of the Royal Society*, Sept. 1, 1903) stated that "even after the lapse of three days (our observations have not extended beyond this limit) the phagocytic power has not declined to less than  $\frac{1}{2}$  or  $\frac{1}{3}$  of that of the blood freshly drawn. We have found no indication of a variation within the space of a few hours." Since then other observers—especially in connection with the tubercle bacillus—have corroborated the fact that the opsonic power of the serum varies little if at all in the course of a few hours after withdrawal. Such a contention is, I think, a dangerous basis for accurate work. It has undoubtedly led to considerable laxity in the matter of control, especially when serum has been sent from a distance and even frequently when taken by the observer himself.

Personally I invariably take the control at the same time as the serum to be examined as on more than one occasion when testing for this point I have found discrepancy in the results to occur.

As regards the details of the technique, I have occasionally, though very exceptionally, found that in the withdrawn blood, hæmolysis had occurred and such serum I have never used, although I am not convinced that any alteration of opsonic power is thereby brought about.

The leucocytes I have employed have always been my own, the blood being taken into 1.5 per cent. sodium citrate solution, centrifuged and washed once in .85 per cent. saline solution. The emulsion used differed in its method of preparation according to the organism tested and its nature will be described later.

In counting, 50 cells were always counted, the estimation of

the bloods of the same test being always made immediately, the one after the other without any definite interval elapsing between the count of any two bloods, and so far as possible recognition of the source of the blood under examination was avoided until the estimation was completed.

The test in general was carried out as advocated by Sir A. E. Wright, and the cases in which it was employed were those of children under 12 years of age, the great majority of these being patients in the wards of the Royal Hospital for Sick Children, to the physicians of which hospital I am indebted for permission to examine the children and to give this communication.

The organisms with which I have worked have been the *diplococcus intracellularis meningitidis*, the *diplococcus rheumaticus*, the tubercle bacillus and the staphylococcus.

#### I. DIPLOCOCCUS INTRACELLULARIS MENINGITIDIS.

In this category I have a series of cases 14 in number in which the opsonic index was estimated on over 100 occasions. The cases were those of acute or chronic cerebro-spinal, including post-basis, meningitis, in which either post-mortem or intra vitam from the lumbar fluid a Gram-negative intracellular diplococcus was obtained. The organisms against which the index was estimated were from 5 sources:

- 1 was an organism sent to me from Belfast by Dr. Rankin.
- 1 was sent to me from London by Dr. Batten.
- 2 were given to me by Dr. Shennon, and
- 1 was obtained from the lumbar fluid of a child in the Royal Hospital for Sick Children who died on the fourth day of illness from acute cerebro-spinal meningitis.

The last mentioned organism has been the one employed throughout, the estimations against the other four being very small in number.

In the making of these estimations an emulsion of a 24 hours' growth was at first employed, but latterly a 9 hours' growth has been used.

With the younger emulsion counting is greatly facilitated as during the period of incubation degeneration of the organisms is avoided.

With the younger growth also it is found that whatever the strength of the emulsion, the number of cocci engulfed by each separate polymorphonuclear leucocyte is small, owing, as has been pointed out, to the fact that with normal serum any marked degree of phagocytosis can not occur until degeneration of the diplococcus has commenced.

In the case of normal serum, agglutination was never observed however long the period of incubation and however strong the emulsion, and in this connection the duration of incubation is of importance as the agglutinative reaction when present is never marked before 10 minutes incubation.

Eight of the cases examined were cases in which death occurred within 28 days of the onset of the disease.

In 7 of these cases, in which the index against the meningococcus was determined on or later than the 4th day of illness, it was found to be high, as high as 15 in some cases, with marked clumping in all. In the remaining case in which there was an opportunity of taking the index 24 hours after the onset of symptoms, it was found to be very low, 0.4 with no clumping. Unfortunately no further examination was obtained in this case against the meningococcus, and the patient died on the 4th day of illness.

In 4 of the cases the index was also taken against the diplococcus rheumaticus and was found to be 2.58, 2.75, 5, and 2.05, in the last case with serum heated for 10 minutes at 60°C., the index was 0.23 as against 0.23 with my own heated serum.

Houston and Rankin from the result of examination in a series of 63 cases of acute cerebro-spinal meningitis state that "from the 6th day onward all the cases examined (with one exception on the 7th day) showed an opsonic index of over 4; several of the cases from the second day onward also gave an opsonic index of much above 4;" and this is very largely corroborated by other observers.

Of the present cases it is interesting to note the very low index obtained at the commencement of the illness in one case, and the somewhat unexpected results obtained against the diplococcus rheumaticus.

The remaining 6 cases were those of chronic meningococcal infection and in one of these the index against the diplococcus

rheumaticus was also taken several times and was found to be consistently high, varying from 1.8 to 2.8 and showing an index of 0.2 with heated serum as against 0.2 with my own serum. In this case the index to meningococcus was low 0.7.

In one case of four weeks' duration, the index was found to be 1, and there was no agglutination with 15 minutes incubation. This case was sent to the fever hospital the same day, from which it was discharged on the fourteenth day in perfect health.

In another case of several weeks' duration it is interesting to note the reaction with the different organisms. With a 9 hours' culture and 14 minutes' incubation the index to the London coccus was 0.5, no clumps; to one Edinburgh coccus was 4.0 with distinct clumps, and to another Edinburgh coccus was too high to count, with marked clumps. The same result was found in this case on more than one occasion.

A possible source of fallacy in comparing these figures lies in the fact that the height of the index here varies inversely as the number of subcultures of the organism used as emulsion, and consequently the possibility is suggested that in cases where a high index is obtained against an organism that has been subcultured, it may be very many times, that the power of resistance cannot be accurately gauged by the height of this reaction, but that a certain amount must be put down as due to loss of pathogenicity on the part of the organism employed as emulsion. On the other hand one finds that with normal serum and the same period of incubation in each case, that the number of cocci absorbed by each leucocyte is approximately the same whether the subculture be the 1st or the 100th generation.

Such results point strongly to an essential difference in the nature of the opsonin in normal and in infected subjects, and also go to show that in gauging the degree of response the degree of subculture must be considered along with the actual figure obtained. That variations in the degree of subculture of different organisms are sufficient to account entirely for the very divergent indices obtained, cannot however be conceded. Undoubtedly marked variations in infected serum occur with different strains of micro-organisms and the height of the index must very largely be a gauge of the amount of resistance. Thus a normal index to an organism

other than the particular infecting one cannot be taken to negative a doubtful diagnosis.

Unfortunately in none of these chronic cases was it found possible during life to grow the organism from the lumbar fluid, and consequently in no instance was a serum tested against the particular infecting organism.

The two last cases of which I have to speak were two long-continued cases of so-called post-basis meningitis. In both cases the child was ill several months, with all the typical symptoms of the disease, and the meningococcus was found in the lumbar fluid. In both cases lumbar puncture was frequently performed without distinct benefit, and in both cases a vaccine was injected.

The index against the meningococcus was frequently taken in both cases and against the same organism, but owing to the fact that the second child was admitted to the hospital at the time when the first child died, the emulsions in the second case were of a much greater degree of subculture than those of the first.

In the first case the highest index recorded was 2.7 and on no occasion was any clumping noted. A vaccine (200 millions—1,000 millions) was injected on four occasions and was followed each time by a negative and positive phase as noted by the index, but except on the first occasion when there appeared to be some slight diminution of symptoms, which, however, owing to the variability of the disease, it was unjustifiable to conclude was due to the inoculation, no distinct benefit was derived.

In the second case the *minimum* index recorded was 10.6 and on every occasion clumps were marked. In this case a vaccine (750 millions and 600 millions) was twice injected with no noticeable results.

Here, it seems to me, we have another point of evidence in favor of the view that with high degrees of subculture the virulence of the organism is so altered that with serum from infected sources apparently very high degrees of resistance are obtained. Houston and Rankin in their observations *commenced* with a subculture of the 35th generation, and it seems to me this may, to a certain extent, account for the very high indices they obtained.

Unfortunately in these chronic cases I have been unable to grow the organism from the lumbar fluid, and consequently have



never had an opportunity of testing a case against a culture of its own organism. To estimate accurately the degree of resistance, this, I think, is essential.

It is noteworthy, however, that while this very high leucocytic power of phagocytosis is noted in certain cases with infected serum, the same does not hold true of normal serum whatever the degree of subculture.

The very high indices obtained by myself (I have obtained indices up to 40) and others seem to me, however, to be of hopeful augury in that they induce one to believe that a very high degree of resistance is capable of attainment by the patient.

If the resistance is to be called forth by a vaccine, that vaccine must primarily be of an early culture and must be prepared from the particular infecting organism, or an organism of the corresponding strain. The first vaccine I used was prepared from the second subculture of an organism obtained from the lumbar fluid of a case of acute cerebro-spinal meningitis and in this instance only was any relief of symptoms afterwards noted. The other inoculations were made with vaccines of much greater degree of subculture.

The vaccine in each case was sterilized by heating for thirty minutes at 70°C. and otherwise was prepared according to the method of Sir A. E. Wright.

Heating at 60°C. for an hour was found insufficient to kill the meningococcus, a pure culture of the organism being obtained afterwards from the liquid.

Rundle (*Lancet*, July 27, 1907), however, reports a case of cerebro-spinal meningitis in which a vaccine was prepared from the organism obtained from the lumbar fluid, which was sterilized for half an hour at 60°C, and which cured the case.

Hector Mackenzie (*Brit. Med. J.*, June 15, 1907) also reports a case of acute cerebro-spinal meningitis in which a vaccine prepared from the particular organism was employed and in which cure resulted. In this case, however, "steady improvement" had taken place before the first injection, and it seems unjustifiable to conclude that the cure was due to the employment of the vaccine.

In both the cases in which I employed a vaccine, I examined the opsonic power of the fluid obtained by lumbar puncture with

a view to note whether in cases showing a high index in the blood serum frequent lumbar puncture might serve to bring fresh opsonic power to the focus of infection. Eve (*Lancet*, July 27, 1906) has compared lumbar puncture with Bier's method of treatment, but so far as my observations go the effect on the opsonic power is somewhat disappointing.

In the first case, examined at a time when the blood serum of the child showed an index of 2.3, the lumbar fluid gave an index of 0.3. Two test-tubefuls were drawn off and one and a half hours later lumbar puncture was again performed and a control serum again taken. The index of the lumbar fluid was now found to be 0.2. (Lumbar fluid from an uninfected child also gave an index of 0.2.)

In the second case three estimations were made. At the first all the obtainable lumbar fluid was drawn off, lumbar puncture was again performed half an hour later and a little fluid withdrawn, and three hours later more fluid was withdrawn.

The index of the blood serum of the patient at the time was 20 and there was distinct clumping. Examination of the fluid first withdrawn showed an index of 0.6, of that withdrawn second 0.8 and of that withdrawn last 0.7.

It would appear, therefore, that the idea of performing frequent lumbar puncture with a view to bathing the parts in a fluid of high opsonic power is not one likely to meet with marked success.

## II. TUBERCLE BACILLUS.

(A) *Diagnosis*.—Wright and Reid (*Proceedings of the Royal Society*, Jan. 30, 1906) state the following: "Conclusions which may be arrived at where we have at disposal the result of an isolated blood examination. (a) Where an isolated blood examination reveals that the tuberculo-opsonic power of the blood is low, we may, according as we have evidence of a localized bacterial infection or of constitutional disturbance, infer with probability that we are dealing with tuberculosis, in the former case with a localized tubercular infection, in the latter with an active systemic infection.

"(b) Where an isolated blood examination reveals that the tuberculo-opsonic power of the blood is high, we may infer that

we have to deal with a systemic tuberculous infection which is active, or has recently been active.

“(c) Where the tuberculo-opsonic power is found normal, or nearly normal, while there are symptoms which suggest tuberculosis, we are not warranted, apart from the further test described below, in arriving at a positive or a negative diagnosis.

“Further test:—When a serum is found to retain in any considerable measure, after it has been heated to 60°C for 10 minutes, its power of inciting phagocytosis, we may conclude that ‘incitor elements’ have been elaborated in the organism either in response to auto-inoculations occurring spontaneously in the course of tubercular infection, or, as the case may be, under the artificial stimulus supplied by the inoculation of tubercle vaccine.”

Struthers Stewart and Peel Ritchie (*Edinburgh Medical Journal*, May, 1907), state as their first conclusion that “a single estimation of the opsonic index is an unsatisfactory method of diagnosis, as both tuberculous and non-tuberculous cases fall within and without normal limits.”

I give these two quotations for the reason that it appears to me essential that, when one speaks of the opsonic index to tubercle, estimated for diagnostic purposes and on one occasion only, the entire test should be employed. Where this is not done, undoubtedly the result is likely to be unsatisfactory and further procedure may be necessary. Where, however, the index is fully taken on one occasion, that is to say where in addition to the ordinary estimation, the reaction with heated serum is also taken, the test is I think very reliable.

No rational person, of course, will deny that two separate tests are better than one, but where that one test is full and complete the result so far as I have been able to judge has been extremely satisfactory. On many occasions the result of the test has been in accord with the eventual clinical result.

Normal serum but rarely shows after heating a tuberculo-opsonic index of over 0.15 while infected serum practically constantly shows a marked proportionate rise.

Thus in one case with an index of 2, the heated serum showed an index of 1.5, in another with an index of 0.6 the heated serum showed an index of 0.2, and another with an index of 0.9,

that is well within the normal limit, showed with heated serum an index of 0.5.

On the other hand a case with an index of 0.8 and an index with heated serum of 0.13, and a case with an index of 0.78 and an index with heated serum of 0.1, were regarded as free from actual tuberculous infection.

Such cases as those last mentioned are, however, undoubtedly on the border line of infection. I have not the slightest hesitation in saying that in very many cases one is totally unjustified in saying this patient is tuberculous or this patient is not. The boundary between immunity and infection is a very varying one, in its ultimate essence an extremely delicate one, and yet again in its degree of latitude a very broad one. Within its limits the greater part of many lives are spent and in every case the limit on either side is, I believe, too subtle for detection. In this method we have at our disposal a test more delicate and more reliable than any that have yet been brought forward.

Shaw (*Lancet*, May 11, 1907) in observations on the opsonic index to various organisms in the sane and insane, states "that the average tuberculo-opsonic index of the non-tubercular insane was below that of the healthy sane, 0.88 as compared with 1.07, which strongly favors the view that the opsonic index can be used as a test of the liability to tuberculous infection."

(B) *Treatment*.—The majority of cases in which I have employed tuberculin treatment have been cases of lymphatic tubercle, tubercle of the cervical, the bronchial or the abdominal lymphatic glands.

In these cases, early and uncomplicated, the opsonic index has been found to be constantly low, and the result of long continued treatment has been extremely satisfactory. The amount of tuberculous infection with which one is constantly confronted is so great that in only a few picked cases can thorough treatment be adopted. The cases I have chosen were those of early or suspected infection and I readily admit that it is impossible in very many to determine to what extent improvement was due to the injections given. In several, however, improvement dated from the commencement of the tuberculin injections and in all as the health improved the tuberculo-opsonic index was raised. In two

cases of lupus and one of tuberculous pleurisy, marked improvement was also obtained.

It is I think essential both as regards dosage and intervals of inoculation that the procedure should be controlled by the estimation of the opsonic index. Tuberculin in my experience is an extremely potent agent for good or evil and so far as I have been able to determine infinitely more powerful as a destructive than as a remedial agent. By this I mean that where given in excessive doses or at improper intervals the harm done is out of all proportion to the greatest benefit which can be hoped for when it is administered in the most judicious manner, and under the strictest opsonic control.

As regards the dosage 1-1500th milligram is, I think, the maximum initial dose for a child of 12. With larger doses the negative phase is marked and prolonged and constitutional symptoms as a rule appear. McIntosh (*Scottish Medical and Surgical Journal*, May, 1907) using doses of 1-1000th m.g.—to 1-500th m.g. in the Aberdeen Hospital for Sick Children obtained very unsatisfactory results, while Riviere (*B. M. J.*, April 13, 1907) recommends the following doses.

1-12,000th to 1-8,000th m.g. to a child aged 1 year.

1-4,000th m.g. to child aged 5 years.

1-3,000th m.g. to child aged 10 or 12 years.

### III. STAPHYLOCOCCUS

In cases of staphylococcal infection I have invariably used a stock vaccine composed of a mixture of the aureus, albus and citreus, and in no case have I estimated the opsonic index. Clinical symptoms are in such cases, I think, a satisfactory guide to the date of reinoculation and to dosage, at any rate where the primary dose is approximately accurate.

To a child of six months old I give 50 million staphylococci and to one of 10 years old 100 million staphylococci as an initial dose. Such doses are, as a rule, followed clinically by no definite negative phase and improvement in the condition is noticeable on the second or third day after inoculation.

In intractable empyemas and in cases of profuse suppuration

I have met with but little success; but in ear cases, combined with tuberculin it has proved extremely useful.

The cases in which the treatment has been most successful have been those of generalized furunculosis in young children. In two such cases I am convinced the treatment saved the life of the child when all other methods had failed, and in all, most marked improvement occurred. But when I say this, I do not mean to imply that in all cases of multiple boils in young children staphylococcic vaccine is a heaven-sent panacea. The cases in which it is of real use are those in which the staphylococcal infection is the primary cause of the evil, in such I think it is of the utmost value. On the other hand, the cases in which one is asked to give an inoculation are frequently those in which a staphylococcal infection is superimposed upon other morbid processes or is a terminal infection, and it is precisely in such cases that little benefit can be expected from the treatment.

#### IV. DIPLOCOCCUS RHEUMATICUS

Through the kindness of Professor Beattie, I have been enabled to make some observations on the opsonic index to the diplococcus rheumaticus, more especially in connection with cases of chorea.

The organism I got from him was obtained from the knee joint of a case of acute rheumatism, and with it I have made all the examinations. The emulsion I have used has been one prepared with 0.85 per cent. salt solution, the strength of solution which I found gave the minimum amount of spontaneous phagocytosis.

The control serum I have used has been my own and to ensure the approximate normality of this, before commencing the observations I compared the serum with that of 15 adults, men and women in apparently robust health, against this organism. Taking my own index as 1 the average index of these 15 healthy persons equalled 1.002 and consequently I felt justified in taking my own as a normal control.

Excluding one case the variations in the healthy sera ranged from 0.75 to 1.27. The exceptional index was one of 1.5, but as this heated serum gave an index of 0.4 as compared with 0.15 with my own and as there was a certain history of rheumatism, I hardly think it can be taken as normal although occurring in

an apparently healthy subject. This index, therefore, although included in the 15 which were taken to ensure the approximately normal nature of my own, I do not consider to be within the normal limits which roughly and for present purposes I take to be 0.75 to 1.25.

In eleven patients suffering from chorea and one patient suffering from acute rheumatism, I have tested the index against this organism. Unfortunately I have only had an opportunity to examine one case of acute rheumatism.

This patient, a girl aged eleven years, was admitted to the hospital on the sixteenth of October suffering from high fever, painful and swollen joints, acute pericarditis and albuminuria. There was a history of four previous attacks of acute rheumatism. The pericarditis was very marked and the child extremely ill.

On the morning of the eighteenth the index to the diplococcus rheumaticus was found to be 0.59—the lowest index I have obtained against this organism. During this day the fever subsided and the physical signs of pericarditis disappeared, and on the nineteenth the child was markedly better. The index to the diplococcus rheumaticus taken that afternoon was 1.1, and with heated serum was 0.45 as compared with 0.11 with my own heated serum. Improvement in the patient's condition steadily continued and her index taken on the twenty-second was 1.3.

On these observations I can of course base no conclusions but it is I think at least interesting to note the very marked manner in which changes in the opsonic index to this organism corresponded with changes in the general condition of the patient.

In none of the cases of chorea was a systematic daily estimation of the index made and in the majority merely two or three estimations were made in the course of the illness. In none also was the test with heated serum done.

The definite exclusion of rheumatism in the history of a child under 12 years is no simple matter, and I do not feel justified in classifying the cases according to the presence or absence of rheumatic infection. Rather shall I ignore the history altogether, with one exception.

In this exceptional case the patient, a girl aged eleven years, was the weakly child of extremely careless and unkind parents.

She had been hard-worked and ill-used and was extremely badly nourished. No history of rheumatism, definite or indefinite, could be obtained, there was no cardiac affection and no signs or symptoms of rheumatism. With simple rest in bed she gradually became quite well and her opsonic index calculated on three occasions was normal.

In the other ten cases of chorea, the striking point so far as the opsonic index is concerned is this, that where the test was done early after admission, the index was low and where it was done late, and consequently where the patient was in an improved state of health, it was as a rule high.

The indices ranged from 0.63 to 1.85. On several occasions the index was found to be practically normal and all such indices occurred where improvement in the clinical symptoms was taking place and on more than one occasion was a definite intermediate step from a low to a high index.

On one occasion only was the index found to be high on admission to the hospital, the case of a girl aged eleven years who had, immediately prior to the onset of the chorea, been treated for rheumatic fever. Her index on admission was 1.2 and before leaving the hospital rose to 1.43.

These facts, scattered and inconclusive as they are, seem to me on the whole distinctly to support the contention of Beattie and of Payne and Poynton as to the specific relation between the diplococcus rheumaticus and rheumatic fever. One is, of course, however, not in a position to say that corresponding opsonic results might not have been obtained against some other organism.

The inter-relation of microorganisms and the inter-relation of opsonins is a subject the complexity of which is sufficiently bewildering. Thus Aikman (*Lancet*, July 13, 1907) cures boils and carbuncles with anti-diphtheritic serum while Bradshaw (*Lancet*, May 19, 1906) and Bosanquet and French (*Brit. Med. Journ.*, April 13, 1907) note changes in the tuberculo-opsonic reaction after such injection.

Charlton Bastian may be considered an enthusiast and extremist, but his work serves as a remarkably appropriate background to many of the problems associated with clinical bacteriology.



# Medicine

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## THE PARATYPHOID FEVERS

BY J. C. WILSON, M.D.  
of Philadelphia

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*Definition.*—A group of infectious febrile diseases, caused by organisms intermediate between bacillus typhosus and bacillus coli, and presenting the clinical phenomena of enteric fever.

*Etiology.*—There are a number of organisms in this intermediate series, including the bacillus enteritidis, and several varieties causing diseases in animals.

Buxton has suggested the following classification:

*"Paracolons.*—Those which do not cause typhoidal symptoms in man. A group containing many different members but culturally alike.

*"Paratyphoids.*—Those which cause typhoidal symptoms. (a) A distinct species culturally unlike the paracolons. (b) A distinct species culturally resembling the paracolons."

Cases of paratyphoid have been reported from all parts of the world in which systematic laboratory work in bacteriology is carried on. It has occurred in series of enteric fever cases, in house epidemics and under circumstances which render it probable that it is sometimes a water-borne disease.

*Symptoms.*—The features of the reported cases are very variable.

1. Many of the cases cannot be distinguished from enteric fever except by the failure of the blood serum to agglutinate b. typhosus and its power to agglutinate the organisms of this group. Hæmorrhage, crural phlebitis and relapse have been observed.

2. Others present the clinical features of septic infections and resemble the so-called typhoid septicæmia or enteric fever with intercurrent or terminal sepsis: cases in which the diagnosis is

reached by exclusion rather than by the presence of the ordinary clinical features of enteric fever.

3. Finally, the organisms have been found in abscesses in cases in which no history of enteric fever has been obtained.

The first group of cases, those which are clinically indistinguishable from enteric fever, are almost always mild and terminate in recovery. The anatomical lesions are therefore as yet undescribed. The last group is without interest in this respect. Cases of the second group may end fatally and Wells and Scott (1904) studied a fatal case of their own in connection with four fatal cases collected from the literature, one of which occurred in my service in the Pennsylvania Hospital and was studied by Longcope. The most constant lesion was enlargement of the spleen. The intestinal conditions were variable. In two of the cases the intestines were normal. Ulcers were present in the others, but they resembled those of dysentery rather than those of enteric fever. In all the cases the solitary follicles, the Peyer's patches and the mesenteric glands were unaffected. The other changes present were those of a septicæmia.

*Diagnosis.*—The direct diagnosis of paratyphoid rests upon the failure of the blood serum to agglutinate *b. typhosus* and its power to agglutinate *b. paratyphosus* or *b. paracoli*.

It is in the highest degree probable that reported cases of mild enteric fever—*typhus levis*, *typhus levissimus*—and cases of the so-called septicæmic variety have been instances of paratyphoid. Whether or not a separate disease should be recognized merely upon the agglutinating properties of the blood serum is open to question. The working hypothesis that clinical conditions not to be differentiated from enteric fever may be caused by a number of allied pathogenic organisms is supported by the facts reported by Achard and Bensaude (1896), Widal (1897), Gwyn (1898) and many observers since.

The following case, recently observed in my service in the Jefferson Hospital, is an interesting example of the first group:

J. E. Q., male, æt. 27, unmarried, a student of medicine, was admitted to the private ward set apart for students, October 4th, 1907. He stated that his health had always been good and that with the exception of mild attacks of several of the diseases of child-

hood he had no sickness until five years ago, when he had an attack of enteric fever. His account of that sickness led us to believe that it was well characterized and unattended by complications. He was confined to bed seven weeks and only gradually regained his usual health and strength. It is not without interest in this connection to note that he then lived in an interior town in Pennsylvania, in which enteric fever has long prevailed and in which an extensive epidemic recently occurred.

The initial symptoms appeared about ten days prior to admission. They consisted of diffuse, dull headache, most severe late in the afternoon, loss of appetite, weakness, inability to work, vertiginous sensations and an unsteady, staggering gait. The bowels were constipated but moved freely after he took laxatives, but without relief of the headache. The symptoms increased in severity. There were two attacks of bleeding at the nose, one of which was profuse. Fever presently set in and a few days later there was annoying soreness in the muscles of the back and extremities.

Upon admission it was noted that the patient was a fairly well developed, well nourished man. He complained of dull headache referred to the brow and occiput, muscular soreness in the neck and back radiating to the arms and legs, and diffuse though moderate abdominal tenderness. The facies was dull and apathetic and there was slight flushing over both malar bones. Pupils alike in diameter, moderately dilated and sluggish. The tongue was dry and lightly covered with a brownish coating, the tip and edges being red. The heart was normal; the pulse large and of low tension, about 100 per minute. The lungs were also normal, with the exception of a few scattered small, mucus râles, more abundant upon the left side.

The spleen was palpable.

The liver dulness was not enlarged; there was no tenderness nor dulness in the region of the gall-bladder. The belly was soft, symmetrical, slightly tympanitic and tender in the right iliac region, where there is also gurgling upon pressure. Careful search failed to discover any eruption. The temperature was 99.3° F., but rose in few hours to 103.4° F.

A provisional diagnosis of enteric fever was made and a laxative dose of calomel administered. Liquid food.





Allowing for a short period of prodromes we estimated the day of admission as about the sixth of the attack. It may have been a day or two later.

The following day, October 5th, there was epistaxis and rose spots appeared upon the abdomen.

Examination of the blood: Hemoglobin 90; erythrocytes 4,810,000; leucocytes 7,000; Widal negative, 1:40-40 min.

Examination of the urine: Clear, brownish red; specific gravity 1024, acid, no albumin, no sugar, urea 2.8 per cent., few triple phosphates, amorphous phosphates and urates, few epithelial cells, few leucocytes, no blood, few granular casts, many bacteria.

October 6th. Treatment instituted. Systematic cold bathing, according to the formula of Brand.

The patient does not like the tubs, but rests well after them and is more comfortable.

Epistaxis again. The spleen is distinctly palpable. New crops of rose spots; a few are present upon each arm.

October 8th. Widal test again negative. Diazo reaction positive.

October 11th. As the temperature no longer reaches the bathing level the number of baths is reduced to two daily and small doses of dilute hydrochloric acid and essence of pepsin were given. Positive agglutination and bacteriolysis with cultures of *b. paratyphoid A*, 1: 50-1 hour (Rosenberger).

Blood taken for culture. Report from laboratory on fourth day: sterile.

From this time the progress of the case was uneventful. The defervescence by tardy lysis was complete upon the sixteenth day. The convalescence was rapid and marked by an urgent hunger. Solid food was given upon the twentieth day of the attack. On October 25th, about the twenty-seventh day of the attack, the patient was dismissed at his own request.

I have to thank Dr. Klopp, the resident physician, for the clinical notes.

This case is not only interesting as a typical instance of the common mild form of paratyphoid not to be distinguished clinically from ordinary mild enteric fever—*typhus levis*; *t. levissimus*—but it is also interesting in view of the history of a previous attack of

enteric fever of ordinary type and moderate severity. It would appear, in so far as a single observation has value, to indicate that enteric—typhoid—fever does not confer immunity against paratyphoid infection. It is therefore possible that the second and the rare third attacks reported may not be cases of reinfection by *b. typhosus*, but of infection by a different though related pathogenic organism, *b. paratyphoid*, and that the permanent immunity conferred by an attack of enteric fever is more general than has been supposed. Further observations upon this subject are needed.

## URINARY ACIDITY WITH SPECIAL REFERENCE TO GASTRIC ACIDITY.—ACID AND ALKALINE TIDES IN URINE DENIED

BY A. L. BENEDICT, A.M., M.D.  
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It is a paradox which seems strange to those not specially engaged in gastro-enterology, that, on the whole, more information as to the general conditions and indications for treatment existing in disturbances of digestion are derived from examination of the urine than of the stomach contents. By this statement, it is not intended to imply that the latter should be neglected. On the contrary, with increasing experience, one becomes less and less confident of his ability to guess at the chemical condition from the symptoms and results of external examination. At the same time, if we were compelled to choose, once for all, between urinary and chymic examination, most of us would choose the former.

To-day, however, I wish to take up a single topic in connection with the urine and a topic which, though not entirely new and original, is still not generally in vogue. At the outset, it should be admitted that, while this method is of great value in throwing light on metabolic conditions, it does not apply so directly to the chemical state of the stomach as might be supposed or, indeed, as we might properly believe from time-honored statements as to the acid and alkaline tides in the urine.

It should not be forgotten that, next to adding to our knowledge of things that are, the most valuable accomplishment of modern methods, is the annihilation of a fallacy. It is disconcerting to have to abandon our faith in time-honored sayings, but such loss of faith is a salutary part of our education in passing from childish to adult methods of thought.

Without particular allusion to the present topic, I also want to call attention to the very irrational but too common attitude of certain critics who gauge the value of work along scientific lines by the brilliancy of the results achieved. It requires just



as much skill and hard work—indeed, usually more—to arrive at a negative than at a positive result. The announcement of a negative result is also of use in saving the time and effort of future investigators and a guarded, properly qualified statement of results in opposition to the temptation to claim as much glory as possible, indicate both a freedom from preconceived notions, and a sort of intellectual heroism.

In taking up the general study of urinary acidity, one is struck with the paucity of literature. Indeed, the standard text books are singularly lacking in definite, quantitative statements on the subject and, with possibly very recent exceptions, do not present the matter in a practical light. Most books give the impression that the urine may be either acid or alkaline, though more often acid. My experience includes a series of 500 miscellaneous urinary examinations, both on healthy and on diseased persons, studied with reference to this particular point. In this series, 14 urines were found neutral, 10 alkaline. This series is merely part of a larger one of several thousand in which approximately the same results appear. I have never found a high degree of alkalinity and all 24 hour samples examined have been distinctly acid. These statements, however, should be qualified as follows: decomposed urine has never been considered nor has urine been included which had been artificially rendered alkaline by the administration of soda, potash, etc. Obviously, in certain forms of practice in which ammoniacal decomposition occurs in the bladder, alkaline urine will frequently be found but the alkalinity is strictly adventitious. Even on a relatively vegetarian diet, in various disturbances of metabolism, in cases of renal disease not involving bacterial decomposition and in the great majority of cases in which the medication would lead to the assumption of alkalinity of the urine, it will actually be found acid. In short, human urine is very rarely neutral or alkaline.

All of the earlier studies of urinary acidity are largely vitiated by the use of litmus as an indicator. There is quite a mass of literature regarding the amphoteric reaction alone. The simplest way to deal with litmus is to discontinue it altogether, at least for such purposes as the present. All things considered, the best indicator for determining acidity not due to pure acids, is

phenolphthalein. It is not ideal, indeed no indicator can ever be so since it indicates that the neutral point is passed to an appreciable amount. As is well known, there is no satisfactory definition of acidity, alkalinity and neutrality and, by adopting different indicators, we may arbitrarily say that a certain mixture is alkaline to one, acid to another. But, on the whole, phenolphthalein places the neutral point about where it should be according to our general conception of acidity and alkalinity and, with a reasonable amount of experience, it gives a fairly distinct contrast of color as the reaction changes.

It is scarcely necessary to remind you that for physiological purposes, we usually work with decinormal solutions and that, when any given amount—usually 10 c.c.—of the fluid investigated is neutralized by the same amount of decinormal solution, we say that its acidity, or alkalinity is 100 per cent. or degrees. Under these conditions, each tenth c.c. of the burette corresponds to one per cent. or degree of acidity or alkalinity. When we are dealing with a single chemical substance, it is also convenient at times to calculate the actual percentage or permillage strength of that substance, and we may also state any acidity or alkalinity due to however many substances, in terms of the corresponding amount of any one of the acid or alkaline factors or of any other factor. For clinical purposes, however, many prefer to state the reaction in degrees.

It is obvious that with such simple equipment as a burette, filled with decinormal alkali, a vial of 1 per cent. alcoholic phenolphthalein solution, a 10 c.c. pipette and a titrating flask or even (what is still better) an old teacup to hold the investigated material, it would naturally occur to many men independently to investigate the acidity of the urine. Sahli, in his *Untersuchungsmethode*, 1902, credits this method to Nægeli but I used it at least as early as 1898 and doubtless many others did so still earlier.

Jean Nicolaidi published in 1900, a book of over 300 pages entitled "*Contribution a l'Etude de l'Acidité Urinaire, chez l'Homme et chez les Malades*," with quite a copious bibliography. While he uses titration methods, they are very different from the simple one here described and by introducing certain arbitrary

ratios and stating results in terms of *mono*-basic sulphuric acid, he renders the subject rather complicated. It is also scarcely necessary to say that actual analysis of various substances bearing directly or remotely on the reaction of the urine, have been performed by numerous chemists. Titrations expressed in terms of oxalic acid, including water of crystalization or as opposed to so much fixed alkali, have also been occasionally published.

The initial articles on urinary acidity according to the method here described, and appearing in the American literature, are by Thomas R. Brown, in the *Philadelphia Medical Journal* of March 2, 1901, and the *N. Y. Medical Journal* of November 4, 1903, and by T. W. Hastings in the *Medical News* of April 4, 1903. These articles deal with the direct titration of urine but pay attention only to degree of acidity.

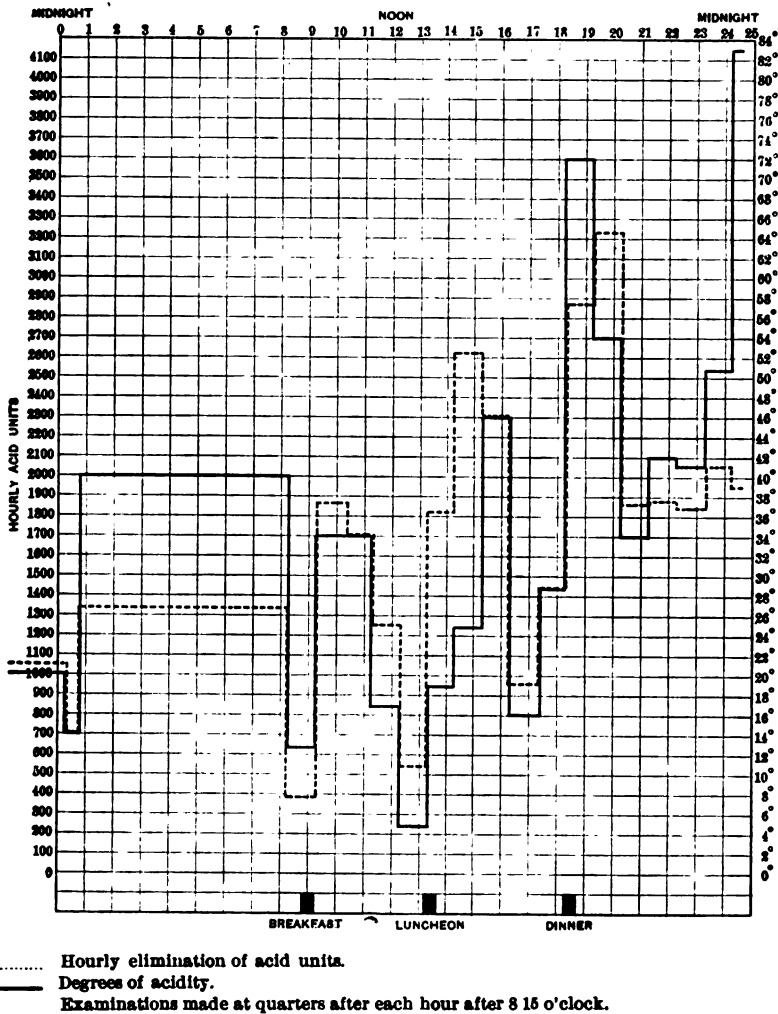
I began the study of urinary acidity in earnest early in 1902 and it soon became apparent that, just as in dealing with any other ingredient of the urine, we must express ourselves not only in percentages but ultimately in actual quantities. Obviously, if two persons pass urine of the same acidity, say 25 degrees, but one passes 1000 c.c. and the other 1500 c.c., the latter has eliminated 50 per cent. more acid factors. Again, both the acidity in degrees and the volume of urine eliminated, vary from one period to another. Hence, the actual elimination of acid factors must be expressed in compound units, representing both strength and concentration of these factors and volume.

I have, therefore, adopted the expression *acid unit*, meaning 1 c.c. of urine—or any other substance—of an acidity of 1 degree. In other words, 1 c.c. of urine exactly neutralized by 1 c.c. of decinormal alkali solution, represents 100 acid units. Average urine is from  $\frac{1}{4}$  to  $\frac{1}{2}$  of decinormal strength. The normal elimination of 24 hours amounts to about 40,000 acid units.

These acid units should not be considered as arbitrary, since standard solutions are prepared on the basis of the gram-molecule. Each acid unit actually represents a perfectly definite number of hydrogen atoms in the acid portion of a molecule but the coefficient is enormous and not definitely known.

It also became evident that we must have a normal basis for comparison, and to establish this I made personal observations

covering, in all, about 40 days, and also made various other similar observations on other healthy persons and patients not seriously affected.



The accompanying chart illustrates the curves of acidity and of acid units hourly. While it was not feasible to examine the urine at so frequent intervals as a routine, the various charts in which the urine was collected at convenient longer periods of the day and night, show that this is typical for myself. The diet

was not accurately controlled but corresponded in general to the Chittenden standard of about 60 grammes of proteid and 2500 calories. It was high in sugars—about 200 grammes—and low in meats—about 100 grammes, corresponding to about 20 grammes of animal proteid. It is scarcely necessary to state that the volumes of urine differed widely and that they can be derived from the chart by dividing the number of acid units by the acidity in degrees.

With very few exceptions, it was found that the highest acidity and the highest elimination of acid units were found sometime during the evening, after the heartiest meal and that they were lowest in the early morning before breakfast or shortly before luncheon. There was no conspicuous difference between these two periods but usually, the minimum was struck in the early morning.

I wish to discuss particularly, the matter of acid and alkaline tides in the urine, their relation to gastric digestion and to perversions of gastric acidity of a more or less permanent character.

First of all, it very early became evident that, neither in the healthy individual nor in patients, could the time-honored teaching of a literal fluctuation between acidity and alkalinity, on account of reciprocal withdrawal of opposite factors from the blood for the digestive juices, be corroborated. Bence Jones, in 1819, stated that the urine became poor in acid after a meal, then neutral and finally alkaline, about 3 hours after breakfast, 5–6 hours after dinner. Görges stated that the urine became alkaline about 2 hours after a meal. Boas in 1894, quoted these and other authors to the same effect with approval, in his *Magenkrankheiten*. Neumeister's "*Lehrbuch der Physiologischen Chemie*" refers to the decreased urinary acidity after a meal as a matter of course and ascribes it to the gastric secretion. He even states that the corresponding opposite effect due to the secretion of saliva is not observed. Considering the very faint alkalinity of saliva and its small quantity, obviously no such influence is to be expected. This teaching of an acid and alkaline tide of urine, corresponding reciprocally to digestive secretion, has been taught with practical unanimity and it was a surprise to me not to find corroboratory results.

It is impossible to suppose that these various observers com-

mitted a gross error in so simple a matter as the reaction of the urine and it is plain that the discrepancy lies with the uncertainty of litmus. Not to mention the controls in healthy individuals, I may say that, for years, the majority of samples of urine which I have examined have been passed by patients in the office, within the first two or three hours after meals but that samples have also been taken at various other times. As stated above, alkalinity or even neutrality has been rarely observed—in not over 5 per cent. of all cases. Thus we must conclude that anything like a regular, total alkalinity of the urine, as marked by a reaction with phenolphthalein, does not occur.

Furthermore, although the urine—for various reasons too well known to require discussion—is usually increased in volume during the first hour or two after a meal, it only occasionally shows a diminution in degree of acidity and almost never any such diminution as to overbalance the increase in volume. Thus, the whole theory of tidal reaction, reciprocal to the digestive secretions and, in particular, to the abstraction of acid factors from the blood in the formation of HCl, seems to be purely imaginative.

If we pause to reflect for a moment, it is clear why this should be so. The old tidal theory, like a great many other notions regarding digestion, was based on the conception that ingested food remained in the stomach for a pretty definite period and was then extruded into the bowel all together. As a matter of fact, the stomach probably begins to empty itself within a few minutes after ingestion. Gastric peristalsis, as well shown by the beautiful experiments of Cannon, occurs in frequent waves and these, even early after ingestion, carry small parts of the stomach contents into the intestine. At an hour after a test meal consisting of 50 grammes of bread, 5 of butter and 250 c.c. of water, we can rarely extract more than 100 c.c. from the stomach, although the contents have received an increment of true secretion. Thus as a matter of fact, we do not have gastric succeeded by intestinal digestion, the one removing acid and the latter alkaline factors from the blood but both proceed nearly synchronously, except that intestinal digestion is probably going on, in one part of the bowel or another, nearly all of the time, and that gastric secretion begins a little earlier than that of the inferior glands. But it is significant that,

instead of there being an acid tide in the urine, late after a meal, we usually find the very lowest elimination of acid units and also the lowest degree of urinary acidity, after the stomach has presumably completely emptied itself into the intestine.

It certainly seems plausible that the urine eliminated in the first fifteen or thirty minutes after a meal should be alkaline or, at least, low in acid units. I have not been able to determine this point positively or negatively. The ingestion of a meal is not a momentary act, the kidneys do not immediately respond to the theoretic causes of diuresis after a meal, the secretion of HCl may precede or follow the actual beginning of ingestion and the quantity of urine obtainable at 15 minute intervals is very small. Thus, viewed from the standpoint of practical experimentation, it is impossible to expect dependable results.

I may say that in venturing to deny the teaching of nearly a century in regard to the normal acid and alkaline tide of urinary secretion reciprocal to digestive secretion, I am relying on actual laboratory findings, that these are entirely contrary to my expectations and that I am open to conviction by further experience.

Now it is obvious that, although the acid and alkaline tide of urine does not seem to exist normally, a marked pathological diminution or excess in the gastric secretion of HCl may very reasonably be expected to be associated with an increase or decrease of the urinary acidity.

The attempt was at first made to determine this point from a single test, as follows:

RANGE OF GASTRIC ACIDITY IN HCL	NUMBER OF CASES	AVERAGES		URINARY ACIDITY
		FREE HCL ACIDITY	TOTAL GASTRIC ACIDITY	
20 and upward.....	27	36	74	32
10 to 19 degrees .....	14	15	53	35
2 to 9 .....	8	5.5	58	27
0 .....	13	0	25	42

There certainly does seem to be a slight increase of urinary acidity reciprocal to the decrease of gastric acidity but it will be seen that the ascent in the urinary acidity is not regular and it should be stated that a single examination of either gastric or urinary acidity, especially the latter, can not be considered as character-

istic of a given case. Moreover the urinary acidities were not all taken at a definite time with reference to the gastric examination. Hence, I consider this portion of my work as valueless and it would not be presented at all if it did not seem to controvert my own views. At any rate, it can be stated positively that a single examination of the urinary acidity is absolutely valueless as an index of the gastric hydrochloric or total acidity, even if taken at a definite time with reference to the test meal, as the fluctuation of urinary acidity is considerable, in any case, from time to time.

The present case is that of a young man with incipient hepatic sclerosis, not due to alcohol—and, indeed, comparatively few of my cases of this disease, in private practice, are connected with excessive indulgence in alcohol and many occur in total abstainers. The urine, for the hour before the test meal was taken, has an acidity of 8 degrees, titrating to the first pink tinge with phenolphthalein. For the hour after the ingestion of the test meal, the acidity is 3 degrees. The urine has also diminished from the unusually large volume of 130 c.c. for the second hour to the still relatively high amount of 80 c.c. for the second hour, so that there has been a decline of acid unit elimination per hour from 1040 to 240. It is scarcely necessary to remind you that the average quantity of urine eliminated in an hour is 40 to 50 c.c., although, within physiological limits, there may be nearly complete suppression of renal function or, if much water has been taken, or, *a fortiori*, tea or coffee, and if there has been mental excitement, the volume may run up at least to 200 c.c.

Now, in this case, we have a generally reduced urinary acidity, the normal average being somewhere from 25 to 50, also a reduction—not very significant, it is true,—of absolute acidity and a very marked reduction of acid units. Such a combination of circumstances suggests the existence of hyperchlorhydria. The past history and former examinations of the stomach contents corroborate this diagnosis. Moreover, we have extracted 250 c.c. of chyme of watery consistence, indicating a free flow of gastric juice. On titrating, we find the hydrochloric acidity to be 50 and the total acidity 85. You will note that in making the titration for free HCl, using dimethyl-amido-azo-benzol as an indi-



cator, I take pains to read at the change of color from cherry to orange. The final discharge of color occurs twelve degrees farther along. You will also note that the tint left after neutralizing the free HCl is merely a light straw yellow which does not interfere with using the same sample for the further estimation of total acidity by phenolphthalein. In the present instance, we might have taken a fresh sample but, in a great many instances, there is not enough chyme to allow such extravagance. I may mention, in passing a few minor points.

It is quite likely that the astonishing frequency of hyperchlorhydria in certain reports, is due to reading the acidity at the final color change with dimethyl.\* (See my articles, Notes on the Tests for Gastric Acidity, *American Medicine*, May 17, June 7, July 19 and Aug. 16, 1902, Feb. 21, 1903.) The mistake is sometimes made by students, of reading the total acidity from the end of the dimethyl reaction to that with phenolphthalein. A moment's reflection will convince you that we must read from the beginning of the double test. Unless the stomach contents are very clear and watery, when we may use the decante to save time, any reliable test for acidity must be performed on the filtrate. Much confusion has arisen in the past from titrating semi-solid stomach contents, which are mixed with difficulty with the alkali. Then, too, it must be remembered that the acidity of different parts of the stomach contents obviously differs greatly, the portions next to the gastric wall being highly acid while the central portion is unaffected for many minutes and never—unless in conditions of acid fermentation—attains the degree of acidity of the superficial portion.

Here we have a case that apparently illustrates beautifully the general low urinary acidity, and the decrease in acidity, which does exist, and is due to the secretion of HCl.

But, in medicine, we must not jump at conclusions from a single case. Here are the results of another case of hyperchlorhydria, of almost the same free hydrochloric acidity, 49, of a total acidity of 67 and a volume of chyme of 150 c.c., in which the general acidity of the urine was high: 62 and 67, respectively—an actual increase after the secretion of HCl was established—and with a falling off of acid units only from 3100 to 2680, which

is not significant, since the difference of a couple of minutes in the duration of the two periods, an extra spurt of urine, or a momentary difference in function due to blood pressure, would account for it.

I might also show you results in achlorhydria, exactly compatible to what we should consider typical of hyperchlorhydria, under the theory of acid and alkaline waves in the urinary secretion. To save time, I will not present the full tables but will summarize, as follows, a rather tedious study of this topic:

Gastric hydrochloric acidity zero, or stomach empty one hour after the test meal, or containing only a few c.c. of chyme of slight or no hydrochloric acidity; 21 cases; average urinary acidity for the hour before the ingestion of the test meal, 33.33; average urinary acidity for the hour during which the test meal was in the stomach, 39.71; respective elimination of acid units, 991 and 1176; average increase of urinary acidity 6.38 degrees; average increase of acid units 185.

Gastric hydrochloric acidity up to 14 (actually, 10, 10 and 11) total acidity 49 (actually 50, 49 and 49), amount of chyme 40, 60 and 225 c.c.; 3 cases; average urinary acidity 27.33 and 29.33; average elimination of acid units, 1166.66 and 1313.33; average increase of urinary acidity 2 degrees; and of acid units 146.67.

Gastric hydrochloric acidity 16—20; total acidity 40—67; amount of chyme 30—450; 7 cases; average urinary acidity 35.57 and 37; average elimination of acid units 1069.28 and 993.28; average increase of urinary acidity 1.43 degrees; average *decrease* of acid units, 76.

Gastric hydrochloric acidity 23—30; total acidity 46—79; amount of chyme 40—250 c.c.; 8 cases; average urinary acidity 26.75 and 27.25; average elimination of acid units 693.8 and 674.75; average increase of urinary acidity  $\frac{1}{2}$  degree; average *decrease* of acid units 19.05.

Gastric hydrochloric acidity 32—50; total acidity 67—86; amount of chyme, 100—275 c.c.; 8 cases; average urinary acidity, 22.22 and 21; average elimination of acid units, 1232.33 and 1138.33; average *decrease* of urinary acidity, 1.22 degrees; average *decrease* of acid units, 119.

The following table will condense these findings still further:

	URINARY ACIDITY		ACID UNITS	
	FROM HOUR BEFORE TO HOUR AFTER INGESTION			
HCl zero or stomach empty.....	increased	6.38 deg.	increased	185.
HCl 10 or 11 .....	"	2. "	"	146.67
HCl 16—20 .....	"	1.43 "	"	76.
HCl 22—30 .....	"	0.5 "	decreased	19.05
HCl 32—50 .....	decreased	1.22 "	"	119.

In spite of the comparatively few cases in each group, the change in the averages is so regular, though relatively small, that I can not believe but that it must be considered as corroboratory of the old theory of withdrawal of acid from the blood, by secretion of HCl. For practical purposes, however, the method has no diagnostic value because, in any one case, other factors may produce opposite results in the urine to what might be expected.

However, the following conclusions are justified.

1. The theory of an acid and an alkaline tide in the urine, depending on digestive secretions, is not correct in the literal sense as human urine, without adventitious causes, is very rarely alkaline.

2. The secretion of HCl by the stomach and of alkaline carbonates by the liver, pancreas and intestine, are processes that nearly overlap. Acid withdrawal alone occurs probably for only a brief period—normally and usually also pathologically—less than an hour. Thus the lessening of urinary acidity after a meal is of brief duration and of slight degree. The former teaching that there was an alkaline tide of urine, even in the modified sense of a diminished acidity, for a period of two or three hours after a meal, is absolutely contrary to fact.

3. Alkaline withdrawal by intestinal digestion probably occurs to the exclusion of acid withdrawal by the stomach, during a period of several hours, beginning three or four hours after an ordinary meal, but, instead of there being a corresponding tidal increase of urinary acidity in this period, it is exactly the time at which the elimination of acid units sinks to the minimum.

4. Alimentary acidity due to fermentation can not be considered directly, indeed, such acidity tends to produce urinary alkalinity or diminished acidity by the production of alkaline

carbonates. On the other hand, the direct neutralization of alkaline carbonates secreted by the digestive glands inferior to the stomach, must be an important factor and, for various reasons, it seems impossible to strike a quantitative balance between the opposite tendencies of fermentative acidity.

5. Theoretically, both the degree of gastric hydrochloric acidity, combined as well as free, and the amount of gastric secretion, should be considered. However as the chyme depends both on secretion and motor function of the stomach—with identical test meals—it is impossible to make an exact comparison along this line.

## TEXTURAL PROCLIVITIES AND IMMUNITY THE PERSONAL FACTOR IN MEDICINE

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It may be fairly asserted that our pathogenic conceptions are now largely dominated by the revelations of bacteriology. He who would venture to ignore or belittle the disclosures opened out for us by this branch of medicine, and take, let us say, as a fixed standpoint in pathology the conceptions which prevailed some thirty years ago, remarkable as they were,—more particularly as illuminated by the genius of Virchow,—would indeed be a bold man.

I am not sure that I shall escape a similar charge if I offer the opinion that it can never be right to regard any branch of our art, and the several sciences on which it is based, from a fixed standpoint, or to believe that the last new revelations herald the dawn of an entirely fresh era in medicine. Especially will it be wrong if the advent of new truths leads us to discard, or neglect, the older ones arrived at by our predecessors. There is no fashion in truth.

I am led to this opinion because I believe that we are now rather too much engrossed with the daily widening revelations and conceptions which reach us by the way of bacteriological researches. This may be inevitable, for there is a certainty and a fascination in such studies.

It is no part of my duty or desire to decry them. I fully appreciate them, and maintain that we must prosecute them unceasingly since they are of the highest clinical import.

It may be asked, how is it possible then to be too assiduous in such research, and in availing ourselves of all its splendid revelations? I venture to hope that I may furnish an answer to this question in the present communication.

While all bacteriological studies are of interest and demand the attention of the physician, I am of opinion that they are tending

in some degree to withdraw his attention from other clinical factors which equally demand careful consideration.

An essential idea in connection with bacteriological research is that of infection. But for this, the subject would be largely divested of its interest and value for practical medicine. Infective processes now occupy a more prominent position than they did a few years ago, both in the minds of the profession and the public. The process of infection implies at least two agents: (a) the intruding or disturbing element, and (b) the host or patient. As we have to regard it, (a) can hardly be benign in quality, and (b) may be genial, indifferent, or resistant.

I am strongly impressed by the fact that one of these two essential conditions is a good deal lost sight of at the present time. We are much engaged with the *seed*, and are insufficiently mindful of the *soil*, for it is a question of seed and soil, and neither may be disregarded for a moment.

This consideration brings us at once in face of the personal factor in each case, and to this element I fear we now pay too little attention. One reason for this lies, as I venture to believe, in the fact that our bacteriological discoveries emanate from the laboratory, and that such research is not seldom conducted there more from the point of view of the experimenting physiologist than that of the clinical physician. The intruding microbe is sought and detected, its toxic mischief is revealed, the measure of its toxicity may be further studied in the lower animals, and the research is considered as complete. The important question of the patient's behavior towards the infection is little, if at all, regarded. It is something, however, to the point if his opsonic index has been ascertained, for this is truly a personal matter. We have still much to learn in respect of the specific variations met with in this new line of inquiry, and careful studies in this direction are being carried out by Wright, Douglas, and others,<sup>1</sup> and some more definite ones by Da Costa in relation to diabetic subjects.

A great impetus to this inquiry may be given by reverting to a consideration of the old doctrine of the diatheses or habits of body which has been allowed to pass into unmerited oblivion since

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<sup>1</sup>Vid. 'Bulletin of the Committee for the Study of Special Diseases,' vol. i, No. 3, Cambridge, Aug., 1907.

the microscope and the teachings of bacteriology have so fully engrossed the minds of our active observers. This, at all events, is a subject of clinical inquiry, one which concerns the soil, or, in other words, the personal quality and proclivities of our patients.

There is now a common disposition to regard sick people as so many human units presenting similar qualities of tissue-resistance, and affording a fairly constant field for observation akin to that of a rabbit or a guinea pig. A little consideration at once renders this idea untenable, and all clinical experience contradicts it. We know that the opsonin test indicates variation from time to time in both the healthy and the sick. I believe that it will not fail to teach us something specific and definite in the case of individuals presenting different habits of body.

Most of us have learned to recognize the physiognomical and other peculiarities pertaining to persons of the arthritic and strumous diatheses. In these individuals we meet with certain qualities of tissue-proclivity, arising, as has been said, from "two different races of cells," and of singularly distinct characters. When I allude to the strumous, I by no means regard him as the tuberculous individual, since I distinctly affirm that the former need not of necessity become the latter, although he is certainly more prone than others to afford a genial soil for the development of tubercle bacilli and all other microbes. Further, in the case of the arthritic individual, I recognize a special textural proclivity to resist the development of tuberculosis, and to arrest its progress when such an intrusion has occurred. I cannot but believe that a study of the degree of textural resistance presented by persons of these habits of body will reveal something definite in respect of each of them, and so far confirm the older teaching of our predecessors as to the specific qualities and tendencies of such individuals. The opsonic test, as Wright, Da Costa, and others point out, has both a diagnostic and a therapeutic clinical value. What we now need is a further study of the textural proclivities of our patients, of the resisting or defensive power possessed in the different varieties of constitution towards infections, so that the degree of this may be regulated by appropriate methods of vaccine treatment. That this study will be fruitful we cannot doubt.

It may be declared that there is little need, and little time, for

inquiries such as these to be made, since, in the presence of obvious infection or suppuration, it has now become imperative, and indiscriminately to procure a culture from the blood or pus of the patient, and to prepare a vaccine from these whenever possible. Our work in this direction is likely to be set on more accurate lines if we can secure a knowledge of the tendencies and defensive powers of the individual we are dealing with.

The main difficulty to be foreseen is that of applying these methods in ordinary private practice. They demand time and skill at the hands alone of experts, and, of necessity, must be rather costly. Many younger men are now being trained for this work in most schools of medicine, and the aid afforded by it is eagerly sought in all well-equipped clinics, both medical and surgical.

These clinical studies lead us on towards that fuller knowledge we seek in respect of the doctrine of immunity. We still ask why some individuals are immune against such infections as those of paludism, tuberculosis, rheumatism, and others. Surely this is a matter concerning textural endowment, subtle enough for our keenest conception, but in all probability dependent on the potentiality, metabolic and other, of the minutest elements in the lymphatic and other systems of the whole organism.

To sum up these remarks, I will plead for a larger consideration of the personal factor, the "soil," peculiar to each individual with whom, as physicians, we have to deal; and I will ask whether we are not rather inclined to drift at present into the position of abstract scientists, and to lose our proper relation to the patient as medical artists if we become engrossed with one side only of bacteriology.

We are now, more than ever, endeavoring to be exact in our therapeutic efforts, and the studies just considered tend to secure precision in our methods. It must not be forgotten, however, that we are only on the threshold of these investigations, and have still to deal with many ailments and morbid conditions which cannot yet be treated with scientific accuracy. Those who suffer from these look to us for aid and relief, and therefore we have to continue on the older lines of our art to minister to them. We cannot afford to discard such practice, and yet I have reason to fear that our younger men are not now set on acquiring the skill and art which



our great predecessors have left for us. There is a growing scepticism as to the older methods, and a consequent inadequate and timid ministrations of them in cases where bacteriology is not directly involved. As medical nihilists and sceptics we shall not long remain appreciable members of the body-politic. It is sadly true that we are neglecting the *materia medica* in these days, and too much given to experimentation with unproved, synthetic novelties, while acquiring but little knowledge of the true value of many of the older approved drugs; and it is equally true that our patients are the worse for this disregard of the experience of our more skilful predecessors.

It remains for us so to think and work that in the days to come it may never be said of us:

*"We think our fathers fools, so wise we grow;  
Our wiser sons, no doubt, will think us so."*<sup>1</sup>

And, therefore, I add, "*ausculta et perpende.*"

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<sup>1</sup> *Essays on Criticism*. Pope, 1707.

## MUCOUS COLITIS

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THE condition known as membranous colitis, pseudo-membranous enteritis, myxoneurosis intestinalis membranacea, fibrinous diarrhoea, tubular diarrhoea, hypochondriasis pituitosa, pellicular colitis, mucous colitis, etc., will be found, if looked for, to be anything but rare, occurring in patients under treatment for chronic dyspepsia, catarrh of the intestines, general debility, neurasthenia, and many other vague troubles. The symptom-complex of abdominal pain, passage of mucus in fæces, and neurasthenia characterizes the condition. Pain and passage of mucus drive the patient to the physician. On investigating a case it will be found that the attacks of pain and voiding of mucus are precipitated by worry, nervous strain, fatigue, and after a time by depressing conditions of every type and degree, physical and mental; that the patient has been treated for a variety of diseases, and this perhaps for a long time; that the majority of cases are women between 20 and 45 years of age, the period of life in which the entire nervous system is most liable to the evils of hyper-excitation; and that the particular fæcal constituent which attracts the patient's attention exhibits considerable variety in its naked-eye characters and in the mode and frequency of its discharge, thus, mucus may be passed daily for weeks or months, or there may be a discharge for a few days, followed by a varying period of freedom, after which the discharge returns. The stools may be of normal consistence, hard, or loose. Frequently a discharge wholly mucus occurs in the early morning, waking the patient out of a troubled sleep, and leaving him exhausted for the day, and suffering from intense abdominal pain.

Considerable difference of opinion has existed, and still exists, regarding the ætiology of this condition. Some observers, among whom are Mathieu, Boas and Akerlund, hold that it has its origin

in anatomical changes in the mucosa of the colon; others, including Einhorn, Glénard and Siredey, consider that it is due to a nervous hyper-secretion of mucus, and that it is a phase of neurasthenia; whilst a third view is entertained by Ewald, Fleisher, Nothnagel, and Hemmeter, *viz.*, that its origin is partly anatomical and partly nervous. Von Noorden has long drawn attention to the fact that constipation excites in neurasthenic and hysterical subjects mucous colitis. All are agreed that the condition is constantly accompanied by neurasthenia. As, owing to absence of fatality in mucous colitis, post mortem observations are few, agreement concerning its cause so far as that may be founded on pathology is at present impossible. If autopsies were numerous such discussion would cease. In the few cases of post mortem examination on record no distinctive changes in the mucosa were discovered. Weigert has failed to find any inflammatory change. Although the condition is more frequent in women (to the extent according to Einhorn of 9 to 1, to Litten of 4 to 1, and to Hemmeter of 3 to 1) it is by no means rare in men; and in these the neurotic element is always largely in evidence. The case-book of a physician who practices gastro-intestinal medicine contains the records of hypochondriacal, sleepless, and overworked business men of middle age, who never take a holiday or, if they do, know not how to enjoy it, interwoven with the life histories of highly strung, sensitive and over-burdened mothers, and hysterical girls.

Of the symptoms mentioned abdominal pain most frequently attracts the patient's attention. In some cases it is described as a dull aching; in others as severe colic. On palpating the abdomen nothing abnormal may be discovered, or painful spots may be located over the transverse or the descending colon. Doubtless the first gave origin to the idea of an inflammatory origin. In some cases a sensation of sinking of the viscera in the left iliac fossa is described, and in a few a degree of Glénard's enteroptosis is found. The pain may or may not be relieved by the passage of mucus, or mucus mixed with ordinary faeces. In a few cases the pain described as neuralgic may be so severe that the patient thinks he is dying, and groans and cries in agony. Whilst most frequent in the regions of the descending colon and left iliac fossa, the pain may be located in the gastric region or may spread over

the whole of the abdomen and a portion of the left lower limb. Its cause is reflex tetanic contraction. The sigmoid flexure may be found swollen, tense, and painful on pressure.

The mucus passed in the *fæces* varies enormously in respect of its quantity and characters. Some stools may consist of mucus alone; other stools from the same patient may present a quantity of apparently normal *fæces* with coagulated masses of mucus lying on the surfaces of the formed portions. The mucus alone, or in contact with *fæces*, may take the form of tubular casts of the intestine, membranous shreds, bands or plates, some of these at times resembling segments of tape-worms. At other times one finds pellicles gray or grayish-white in color containing embedded in their surface epithelial cells from the mucus-secreting glands of the colon. Large solid masses of coagulated mucus are seen in many of those cases in which the attacks of neuralgic pain above-mentioned occur. It is of interest to note, especially in connection with the pathology of this condition, that mucus is never found in the liquid condition and intimately mixed with the other bowel contents, as invariably occurs in all forms of inflammation of the mucosa.

If the *fæces* be carefully suspended in water the mucus masses can be unfolded and microscopic examination will readily distinguish them from undigested pieces of tendon, muscle, fascia, and epidermal structures, animal and vegetable. A hyaline structureless matrix is seen which becomes cloudy on addition of acetic acid. Columnar epithelium in all stages of degeneration, triple phosphates, plates of cholesterin, and various *fæcal* constituents are embedded in this matrix. The small number or total absence of leucocytes in it is a significant feature, and settles in the negative the catarrhal origin of mucous colitis. Microorganisms are not found in greater number or variety than in health, except in those cases where catarrhal changes have supervened on the original condition. It would seem that bacterial affections of the colon bear no *ætiological* relation to mucous colitis. The chemical composition of the mucus has excited much interest. It has been variously described as chitin, keratin, fibrin; there is no doubt that the chief constituent is mucin. The chemical reactions of coagulated mucin are somewhat different from those of fresh mucin.

The majority of patients, as has already been stated, are neurasthenic. It is impossible in this paper to go into the details of neurasthenia.

The cause of the condition does not lie in neurasthenia, but behind it. Mucous colitis and neurasthenia are results of a common cause. All catarrhal affections associated with mucous colitis are secondary. It is only to be expected that infections will occur in a mucous membrane removed from a state of health; but it must be distinctly understood that the treatment of catarrhal or inflammatory conditions, as by mineral waters, etc., is of no avail in mucous colitis.

Roger and Tremolières have traced the cause to the liver. The coagulation of mucus in common with that of blood, milk, etc., is accomplished by the action of an enzyme which Roger has named mucinase. The prevention of the coagulation of mucus in health in common with that of blood, milk, etc., is effected by a third body, an anti-coagulant, a normal constituent of healthy bile. It is well-known that many neurasthenics suffer from ptoses of the abdominal viscera, including that of the liver, by which serious interference occurs in the relations which normally exist between the secretory cells and their portal and systemic blood supplies. Such interference *inter alia* results in the failure of the organ to produce the anti-coagulant. Roger has shown that the bile contains a substance antagonistic to the action of the ferment mucinase; this body is soluble in alcohol and unaffected by boiling. Nepper and Riva have shown that the false membrane is the result of an increase of mucinase and a simultaneous diminution of the anti-coagulant. These workers have prepared an extract of bile which, when injected into the colon, acts as an excitant to biliary secretion and also supplies the anti-coagulant wherewith the excess of mucinase secreted by the epithelial cells of the intestinal mucosa is neutralized. By their experiments they claim to have established (1) that mucous colitis is produced through a diminution in the supply of bile, and that where no such diminution occurs mucous colitis does not exist; (2) that the false membrane is the direct result of an augmentation of mucinase and a simultaneous diminution in the bile of anti-coagulant.

I am using such an extract of bile; and, whilst I have not yet

treated a sufficiently large number of cases on which to base a statement, I may say that my results so far are in complete harmony with those of Nepper and Riva.

This natural explanation of mucous colitis accounts not only for the presence and characters of the membrane, but also for the associated constipation, and many toxic conditions resulting from diminished hepatic activity, all of which have been included in the term neurasthenia. It would seem that a ray of light has at last fallen on the treatment of this hitherto intractable condition.

In conjunction with the rectal injection of the biliary extract, it is necessary carefully to select a dietary from which the least amount of toxic materials will pass to the liver. I find in this connection, as in so many other conditions of the alimentary tract, the greatest assistance in the use of a properly prepared and genuine dried milk. Such a product should be desiccated immediately it is drawn from the animals, before bacteria have had the opportunity of forming toxins indestructible by heat. The freedom from toxins and absolute sterility of such a preparation are factors of inestimable value in the treatment of this and many other forms of gastro-intestinal disease.

The prolonged use of mineral waters is in my experience valueless except in those conditions where there exists an associated catarrh. The cures of Carlsbad, Kissingen and other spas are never complete, but ever in process of repetition.

## THE NORMAL TEMPERATURE OF THE BODY

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WHAT the normal temperature of the human body is seems at first sight to be an already answered question for all thermometers and most temperature charts have a mark upon them, which in the case of the charts is usually labelled "normal temperature." The point thus marked is either 98.4 or 98.6 Fahr.

In this short communication I hope to show that the temperature in normal individuals is very frequently much below 98.4 F., and indeed will venture to urge that the average or mean temperature of the human body, taken by ordinary clinical methods, is considerably below this point.

Probably the first physician, who applied the thermometer to the taking of the human temperature, was Santorius. He died about 1638. He also invented a weighing machine, and considered that the two principal criterions of changes affecting the whole body were the bodily weight and the bodily temperature. He lived before his time, however, and it was nearly a century later when the measurement of the bodily temperature was again attempted by Boerhaave and his pupil, Van Swieten. Since their time an enormous amount of work has been done upon the subject, but it remained for Wunderlich to bring it within the pale of practical medicine. He published in 1868 his great work upon Medical Thermometry, and although much work has since been done, little of real value has appeared which was not laid down in that classic.

It seems strange that with such fixed factors as the human body and a clinical thermometer such different results should have been obtained as regards the normal temperature of the body. Yet one finds, for instance, Van Swieten stating that "It is rare, indeed, even in the strongest man, to find the temperature exceed 96 Fahr., but when it rises above 100 Fahr. in diseases, the blood and its serum are disposed to coagulate."<sup>1</sup> While on the other hand, Piorry, who did much for medical thermometry in the way of ad-

vocating its clinical value, stated that "the temperature in healthy persons in the axilla was 32 Reaumur (i.e., 104 Fahr.), and even more." He wrote in 1838 and had taken the temperature in 91 individuals, and one can only presume that his instruments were faulty.

When Wunderlich first advocated the use of the clinical thermometer he was opposed in many quarters, and one cynical French critic wrote that the method "was an empty windbag, which could only amuse physicians in those little German hospitals where the number of the staff almost equalled that of the patients."<sup>1</sup> Since the time of Wunderlich the clinical thermometer has become such an all present instrument that the general practitioner would scarcely feel justified in attending a patient without having it with him.

I have not been able to find when and by whom the thermometer and the temperature charts were first marked with a line or arrow at the point labelled "normal temperature." Certainly Wunderlich's charts were not so marked, although he states that "For the beginner it may, perhaps, be useful to mark the *space* between 97.5 Fahr. and 99.5 Fahr. in some way; with a red pencil for instance, in order to denote the range of normal temperature."<sup>2</sup> However, since the marking of the thermometers and charts has come in, I think that the point 98.4 or 98.6 has been obtained by taking the temperature with unusual precautions. Dr. M. S. Pembrey, who has in recent years done so much work in this direction, writes<sup>3</sup> that "The range of temperature in healthy men and animals has not been adequately determined. This is chiefly due to errors in the methods and the times of observation. In the case of man reasons of convenience and delicacy have led to the observation of the temperature in the mouth. Such a determination is not an exact measure of the internal heat of the body. The balance of evidence shows that Lorain rightly maintained that the temperature in the rectum alone represents the internal heat of the body. . . . It is only necessary to insist that a so-called half-minute thermometer will not give true value of the temperature of the body under different conditions, even if it be retained for five or ten minutes under the tongue of a firmly closed mouth." It appears that we have been trying to live up to a physiologically perfect standard with very imperfect



methods, and for some years it has struck me that the average temperature of healthy individuals taken with ordinary clinical thermometers in the ordinary way, i.e., with due precaution against taking it soon after eating and drinking, etc., is lower than 98.4 Fahr.

Some time ago, in order to test this point, I interested the third year class of medical students in the University of Toronto in the matter and they went into the research with great zest. Each student took his temperature night and morning by the mouth. They were specially cautioned to not take it within an hour of meals, were to shake the thermometer down very low and were to leave it under the tongue for at least five minutes. Nearly a thousand observations were thus made and handed in to me. I then had the results averaged, and we found that the average morning temperature of the class was 97.637 Fahr. and the average evening one was 97.677 Fahr. This observation was made in November, which, as I have since learned, is a very pertinent thing to note. Both these temperatures are, be it noted, within Wunderlich's limits of the normal temperature and would be within the red line, which he recommended "for beginners."

Since that time I have taken the temperature of a great many healthy individuals of all ages and of both sexes and find that it is quite exceptional to get the temperature in the mouth up to 98.4. Recently I have examined a number of temperature charts in the Toronto General Hospital in regard to this point. They were all those of surgical cases and were carefully selected so as to be as free as possible from conditions likely to disturb the temperature. Such cases as those of cataract, simple fractures, varicocele and the like were chosen. They were otherwise taken consecutively, just as they were filed away. In almost all of them there were many temperatures noted as below 97.5 Fahr.; and in the majority, in fact in 208 out of the 350 examined (59 per cent.) the temperature ran almost persistently between 97 and 98 Fahr., so that if one looked along the charts in profile the average temperature would be about 97.6 Fahr.

At the Victoria Hospital for Sick Children a number of charts were examined in the same way, and with somewhat similar results, although it was apparent that, on the whole, children's temperatures

tend to run at a higher average than do adults'. One reason for this is no doubt that in children under about three years of age the temperature is usually taken per rectum, but even in children above that age the temperature is on the whole higher than in adults. Still, a great many of them,—44 per cent. of them all, were on the average below 98 Fahr. On studying the charts of many children suffering from so-called non-febrile complaints, such as strabismus, club foot and the like, the well known instability of the temperature in early life becomes emphasized. My old friend, the late Dr. G. A. Peters, used to warn nervous mothers against having a clinical thermometer in the house, and one has often seen the value of such advice.

On carefully watching the temperature of several healthy individuals over a lengthy period it became evident that it tends to be lower in cool weather than in warm, and an analysis of the charts studied in the two hospitals above mentioned gave the following results in this regard:

In January	78.3%	of the charts	showed a temp.	well below	98.4
February	74	"	"	"	"
March	72.4	"	"	"	"
April	71.4	"	"	"	"
May	45	"	"	"	"
June	31	"	"	"	"
July	38.5	"	"	"	"
August	50	"	"	"	"
Sept'ber	63	"	"	"	"
October	80	"	"	"	"
November	82	"	"	"	"
December	71	"	"	"	"

These figures are of course only approximately correct, as there was no way of absolutely labelling a chart normal or otherwise. But if a chart be looked at in profile a very good average of the temperature can be struck. It is at once evident that temperatures tend to be lower in cool weather than in warm; that in fact the human body is not perfect in its compensation against variations in the surrounding temperature. This seems to be specially marked when the weather first changes and thus in October and November

there were more low temperatures than in December and January, and on the other hand there were fewer in June than in August. The work that my class did was in November and hence gave a lower average result than it would probably have given if done in June. Yet even in June the mean temperature of the cases was well below 98.4.

In the studying of hospital records there is apt to be a margin of error telling against the recording of the low temperature, in that the nurses are looking for the presence or absence of fever, and I fancy are sometimes content to shake the thermometer, especially if it be one that requires a good deal of shaking, only down to the arrow mark.

As regards the temperature in the different sexes, I have made no extended observations, but have got the general impression from a certain number that on the whole it tends to be higher in the female.

Regarding the different periods of life, children seem to have, as already mentioned, higher temperatures than adults. In old age it is generally believed that the temperature again tends to be a little higher, most authorities, including Wunderlich, stating this to be the case; Tigerstadt<sup>3</sup> puts it as 1.10 Cent. above the young adult. But Vortisch found the average temperature in seven persons between 67 and 85 to be between 96.9 and 97.9 Fahr., and agrees therefore with a recent remark of Kelynack that the aged may be febrile while the thermometer shows only a normal temperature.<sup>4</sup> With the belief that the temperature tends to run rather higher in the aged I am inclined to agree and in 9 non-febrile cases studied, whose ages were between 60 and 77, there were only 2 in which the temperature ran below the so-called normal line.

One can summarize these notes in the following way:

I. The human temperature taken with ordinary clinical precautions is usually below 98.4, and hence this point cannot be called the normal temperature.

II. It is suggested that we should employ thermometers and charts in the way that Wunderlich did, viz., without any so-called normal temperature marked upon them.

III. If charts and thermometers be wanted with the normal temperature marked upon them (*i.e.*, for beginners as Wunderlich

It is easy of course to make the normal temperature pass either of these limits, especially the upper one—for example, by exercise, hot baths, etc., but the pulse may be altered in the same physiological way. These limits are for the healthy individual at rest in a temperate environment. Any temperature within these limits would be called normal, the term subnormal being reserved for temperatures below 97.2 Fahr.

Name \_\_\_\_\_ Case No. \_\_\_\_\_

**MONTH**

DAY OF MONTH	TEMPERATURE	PULSE	RESPIRATION
1	105	140	45
2	104	130	40
3	103	120	35
4	102	110	30
5	101	100	25
6	100	90	20
7	99	80	15
8	98	70	
9	97		
10	96		
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suggestive of some infection than would be one ranging a degree lower.

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# Surgery

## DISEASES OF THE GALL BLADDER \*

BY JOHN B. DEEVER, M.D.

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MR. PRESIDENT AND MEMBERS OF THE CUMBERLAND COUNTY MEDICAL SOCIETY:—The distinction of addressing the Cumberland County Medical Society is an honor I highly appreciate. The selection of a subject upon which to talk to you to-night has given me much thought indeed. I have purposely taken a practical, instead of an ultra-scientific one, feeling that I could better deal with the former, to the advantage, I hope, of us all. In making a choice of topic I have not been unmindful of the internist's as well as the surgeon's interest, therefore have tried to strike a common ground. There are few, if any, of the more important medical questions of the day that are not the common property of both physician and surgeon, questions the proper solution of which calls for both to work hand in hand, if the best interests of the patient are to be served. For example, within recent years, and at the present time in particular, both the physician and the surgeon are earnestly engaged in the solution of the pathological problems presented by diseases of the gall bladder, the pylorus, the duodenum and the head of the pancreas, the limitations of which lesions may be encompassed by a very small area in the upper right abdominal quadrant. Lesions in this small area can be further obscured by disease of the terminal end of an appendix that holds a northerly position extending as far up as the gall bladder.

It is not my purpose to deal with all the lesions that may here be presented, but simply with one of the more common ones, a phase of gallstone disease which must appeal to the physician as well as to the surgeon, namely, disease of the gall bladder. This cannot but interest the physician, as it is he who usually sees the patient first, and is offered the opportunity to make the diagnosis and to put the patient on the proper road to recovery. Furthermore,

\* Read before the Cumberland County Medical Society, at Portland, Me., December 5, 1907.

it will be admitted that certain forms of gall bladder disease are amenable to medical treatment, and others to surgical treatment alone. This subject therefore offers a field for argument in which both physician and surgeon should be heard.

*Disease of the gall bladder* is a manifestation of some form of infection, the results of which vary within the widest limits. Traumatism can play a rôle in the causation of cholecystitis only in the presence of infection, or of lowered resistance, or of a stone impacted in the cystic duct. The two chief factors in the causation of gall bladder disease are infection and stasis of bile. Stasis of bile unaccompanied by infection does not cause cholelithiasis. Prolonged experience with diseases of the biliary tract has convinced clinicians of the truth of the statement made by Terrier that the origin of all such diseases is in some form of bacterial infection. The different bacteria found in the gall bladder in their order of frequency are, *Bacillus coli communis*, *Bacillus typhosus*, *Staphylococcus pyogenes aureus*, *Streptococcus pyogenes* and *Staphylococcus pyogenes albus*. The avenues, by way of which infection reaches the gall bladder, are, by direct extension up the common duct from the duodenum, by the portal circulation, the hepatic artery, and through the walls of the gall bladder from the peritoneum. It has been stated that the sterility of the healthy duodenum hinders entrance of bacilli into the gall bladder by way of the intestine. That infection of the gall bladder does not take place oftener is owing to non-interference with its drainage; since with a patent cystic and common duct—and this insures normal drainage—bacteria are prevented from entering the gall bladder by the free flow of bile.

In cholecystitis due to infection by the colon bacillus, while the bacilli may enter the gall bladder by way of the intestine, it is more likely that they enter by way of the portal vein. Rolleston states that infection of the gall bladder may result from the absorption of virulent colon bacilli from an intestinal ulcer or possibly from an inflamed vermiform appendix.<sup>1</sup>

*Bacillus typhosus* may enter the gall bladder by direct extension from the intestine or through the blood. Bacilli found in the gall

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<sup>1</sup> The latter is an explanation of cholecystitis and appendicitis existing at the same time.

bladder long after an attack of enteric fever are descendants of those which caused the original illness. Involvement of the liver and gall bladder invariably occurs during the course of enteric fever. Not infrequently an enlarged and tender gall bladder can be detected during enteric fever without there being any subjective signs of cholecystitis.

Acute cholecystitis following pneumonia is due most probably to infection of the gall bladder with the *diplococcus pneumoniae*; and cholecystitis occurring during an attack of influenza to Pfeiffer's bacillus, the specific microbe of that disease.

We must not lose sight of the fact that because bacteria are not found in the gall bladder at the time of operation, they did not exist earlier in the case. When the *Bacillus coli* has excited the inflammation it may quietly disappear after causing the mischief and therefore be no longer demonstrable.

Traumatism of the abdominal wall with rupture of the gall bladder I have seen in two instances: one case, an adult sailor, was injured by being thrown against the upper abdomen. This patient was not operated on until several hours after the injury, and had already a general purulent peritonitis. He did not recover. The second patient was a boy, a patient of my friend, Dr. Adam Klemm, of Philadelphia. The ruptured gall bladder was immediately due to injury to the abdomen. I had the opportunity of operating upon this patient early. The technic consisted simply in the introduction of a drainage tube through the site of rupture. The peritoneal cavity contained a large amount of bile and was irrigated; a glass tube was placed deep in the pelvis above the pubis. The patient made an uneventful recovery.

As remarked by me in a previous paper upon this subject, any statement, however brief, of the underlying facts of gall bladder disease must be based upon a correct understanding of gall bladder pathology as seen and worked out by the surgeon at the operating table. The autopsy made on the operating table has clearly proven the insignificance of post mortem pathology when compared to the pathology of the living.

In considering the pathology of the gall bladder, the layers of the wall of this organ are of great significance;—the serous covering on account of the adhesions it contracts with neighboring or-



gans; the musculature, on account of its contractions, which give rise to colic, and its density, whether thick or thin; and finally, the mucous membrane, the origin of all evils, including by far the most frequent of all affections of the biliary tract,—that of gallstone formation.

Cholecystitis is the most common variety of disease of the gall bladder itself. The type of cholecystitis depends upon the virulence of the infection and the resisting power of the walls of the gall bladder. A gall bladder which has been previously diseased, but has recovered from the inflammatory attack, is more vulnerable than one previously healthy.

The inflammation of the mucous membrane may range from simple catarrh or ulceration, up to total necrosis. In consequence of the ulcerative type of cholecystitis, particularly when it involves the neck of the gall bladder, there may ensue stricture, perforation, fistula or hæmorrhage. Stricture of the neck frequently results in obliteration and shutting off of the gall bladder from the biliary tract. In acute cholecystitis the cystic duct may be obstructed by a stone, by swelling of the mucous membrane, by kinking of the cystic duct, and by enlargement of the lymphatic node in relation with the duct.

Hydrops of the gall bladder is perhaps always due to an infectious catarrhal inflammation, of slight degree, in which the mucous glands are stimulated to advanced activity. Obstruction of the neck of the gall bladder or cystic duct by a stone, in the absence of inflammatory processes, are exceptionally causes of hydrops.

In the suppurative form of cholecystitis adhesions are more numerous because of extension of the infection to the peritoneum of the surrounding viscera, such as the hepatic flexure of the colon, the duodenum, pylorus, the gastro-hepatic omentum and the great omentum, all of which are in close relation with the gall bladder. In ulcerative inflammation of the gall bladder where, from adhesive peritonitis, the gall bladder becomes adherent to the pylorus, duodenum, or colon, a communication between it and one of these viscera may be established (internal biliary fistula), causing vomiting of bile, contraction and stricture of the pylorus or partial obstruction of the bowel. Upon more than one occasion have I met with a cholecysto-gastrostomy and a cholecysto-duodenostomy

in the presence of stones in the gall bladder and common duct. Once having caused cholecystitis, gallstones will become quiescent.

Recurrent attacks of inflammation of the gall bladder gradually thicken its walls and lead to shrinkage of the organ with perhaps stricture or distortions, hour glass contraction, etc. The progress of disease of the gall bladder is characterized by periods of exacerbations alternating with periods of latency: it must not be forgotten, however, that these exacerbations may be so slight that the disease is not even suspected until the advanced stages are reached.

Phlegmonous cholecystitis, an example of the most serious type of inflammation, like the same condition in the appendix, is due to the high virulence of the infection that results in total destruction of the gall bladder before the peritoneum can protect itself.

Cholecystitis may be a complication of an attack of enteric fever or may occur as long as fourteen, twenty, and in one of my cases, forty-one years after the attack of fever. When cholecystitis occurs during enteric fever it is seldom associated with cholelithiasis. Acute cholecystitis coming on several months or years after an attack of enteric fever is more likely to be associated with cholelithiasis. Attention has been called to the fact that relapses in enteric fever may often be traced to chronic typhoid infection of the gall bladder. As in the appendix, drainage plays a very important rôle in cholecystitis. Occlusion of the cystic duct means bottling up inflammatory products in the gall bladder,—a condition which will not be relieved until the cystic duct again becomes patulous,—provided the gall bladder does not perforate in the meantime. Perforation into the gut or peritoneal cavity, it is true, permits emptying of the gall bladder, but there is no guarantee that such drainage will be permanent. The patency of the cystic duct is usually restored when the acute inflammatory swelling of its walls subsides, and then the products pent up in the gall bladder may escape *per vias naturales*, provided that they carry along with them no stone large enough again to block up the cystic duct.

After expulsion of its products through the now patent cystic duct, the gall bladder resumes its normal physiological functions, if not too seriously diseased, and the gallstone disease becomes latent.

"After subsidence of a cholecystitis the gall bladder may be found in one of the following conditions:—

"1. With the cystic duct closed by a stone, by swelling of the mucous membrane, or by a cicatrix (thus arises hydrops, if the infection be extinguished; empyema, if it still exists).

"2. Wide open, patent cystic duct, with walls completely normal or but slightly altered, or adherent to neighboring stomach, intestine or omentum, and united by fistulae. The stones may be evacuated, but in most cases remain behind." (Kehr.)

It is not quiescent gallstones that drive patients to the operating table. Quiescent gallstones are those that exist in the absence of infection, and may inconvenience the patients only in so far as they cause chronic dyspepsia. But let infection reach the biliary tract, and the stones are stirred from their slumbers into action, and seek to escape from the unwelcome invader. And they can escape, if small, and if lying close to the cystic duct, into the common duct, along which they travel, urged on by the *vis-a-tergo* of bile from the hepatic duct and gall bladder. The stone, being small, remains for a long time in the common duct, because there is space between it and the wall of the common duct for the bile to pass. Should, however, this passageway be suddenly obliterated by concentric additions to the bulk of the stone, complete blockage of the common duct occurs, bringing about cramps, jaundice, chills, fever, etc. The cramps, which are due to increased peristalsis of the musculature of the biliary tract, succeed in driving the stone into the duodenum, provided it is not too large to pass the ampulla of Vater. If too large, it may remain in the common duct, in which instance it acts as a ball-valve; it may ulcerate into the greater peritoneal cavity; or it may reach the duodenum indirectly, as I regret to say I have seen, by perforating the wall of the common duct, and that of the duodenum, through a choledocho-duodenal fistula. Delighted though the patient and attending physician may be, upon recovering the offending stone from the stool, yet the final chapter is not necessarily concluded. There may be other stones to follow; or if the ulceration and perforation heal, the resulting scar may contract sufficiently to cause stricture, which, in turn, dams back the bile into the liver, thereby producing biliary cirrhosis, and if not biliary cirrhosis, then pancreatic cirrhosis,

if the stricture is situated near the ampulla of Vater. Furthermore, in its death throes, the infection, octopus-like, may involve in adhesions, any part of the biliary vesicle or ducts and the liver, colon, stomach or duodenum, or omentum—a veritable cobwebbed abdominal attic—leaving the patient to suffer from the evil effects thereof. How often the surgeon, at antemortem autopsy, can trace the path of devastation and ruin caused by the terrible efforts of the stone (or stones) to escape from their biliary prison, aided by its faithful accomplice, infection, which, always anarchistic, wreaks mighty vengeance upon the gall bladder and its neighboring structures, leaving them always subject to attacks of succeeding generations of infection. Less venturesome stones may remain, cowering in the gall bladder, offering no obstacle to the peaceful flow of the bile, and disturbing the patient not one whit. But hydrops of the gall bladder may at any time ensue from the old infection.

I have frequently seen the lymph-node on the cystic duct so enlarged and hardened from repeated attacks of cholecystitis, as in itself to simulate a calculus in the cystic duct.

If empyema of the gall bladder or pericholecystic abscess result from the infection, and remain untreated, fistulæ may arise between the gall bladder itself—or the pericholecystic abscess—and the gastrointestinal tube (internal biliary fistula). Or in case the gall bladder becomes adherent to the anterior abdominal wall, the pus may point at the thinnest part of the latter, the umbilicus (external biliary fistula). Above, it may perforate the diaphragm, and enter the pleural cavity or lung. Below, it may enter the pelvis of the ureter, or, as in a case reported by Agnew, may point beneath Poupart's ligament. Serous membranes in other parts of the body, such as in the heart or meninges, may be secondarily infected, from the infection in the gall bladder which acts as the primary focus.

In middle-aged persons, the possibility of cancer arising in the wake of gall bladder disease must ever be borne in mind.

I have depicted above the none too black, dire consequences of gall bladder disease, for I have either seen such examples myself, or else culled them from the literature. Fortunately, however, such extreme cases of gall bladder disease are becoming rare, for

physicians are fast learning to appreciate the value of early operation in this malady, just as they learned it years ago in appendicitis.

The symptoms and signs of acute cholecystitis are similar to those of acute appendicitis, with the exception that in one the upper, and in the other the lower part of the right side of the abdomen is affected. According to Robson, a rigid right rectus abdominis and tenderness one inch above and to the right of the umbilicus is as suggestive of gallstone trouble as is McBurney's tender point of appendicitis. This differential diagnosis is sometimes difficult and even impossible, especially when the tip of the appendix impinges upon the gall bladder, and in the absence of a gastric history. The referred pain in gall bladder inflammation is usually to the back and right shoulder. When the pylorus is involved by adhesions there is a tender spot under the left shoulder blade. Acute cholecystitis is not accompanied or followed by jaundice unless the inflammation extends along the cystic into the common duct. In acute cholecystitis, in addition to pain referred to the gall bladder region, and tenderness and rigidity, the gall bladder is enlarged and may be palpable. Tumor of the gall bladder, however, is usually important and demonstrated only in cases of hydrops and empyema when shown in the course of gallstone disease, and occasionally when the gall bladder is impacted with stone or distended with bile due to an obstruction of the neck by a circular carcinoma, or by enlargement of the head of the pancreas. In many cases the gall bladder lies far up under the liver and it is only its sensitiveness to pressure that guides one to this organ as the seat of lesion. But a palpable swelling is not always to be made out on account of the very tender and rigid state of the overlying abdominal wall, and further on account of malposition of the gall bladder which occasionally occurs. Very delicate palpation is much more likely to detect it, however, if enlargement be present.

The symptoms of chronic infection of the gall bladder are, dragging sensation in the right side; a slight feeling of oppression in the stomach; indigestion manifested by eructations of gas, and at times anorexia, and hyperchlorhydria; and pain after food, which will not come on for some hours, but usually attacks the patient at night or in the early hours of the morning. It fre-

quently happens that in the absence of obstruction of the cystic duct, and subsequent development of hydrops of the gall bladder, there is no discomfort. Even with stone in the common or hepatic ducts the course of the disease may be latent. The immediate cause of colic is an inflammatory process,—a slight infection reaching the gall bladder by way of the common duct, which, in the presence of stone may bring on colic by exciting an inflammation which forces the stone into the cystic duct.

From statements in text-books, the notion is widespread that gallstones may exist in the gall bladder for many years and not cause symptoms. I do not believe this. Such teaching, handed down to us, we were willing to accept until the pathology of the living taught us otherwise. I believe that many cases of indigestion, the so-termed gastralgia, catarrh of the stomach, gastritis and so on, but where jaundice has never been present, are the result of gallstones which, while not causing trouble definitely referable to the gall bladder, nevertheless are factors in many ailments for which patients take so-called digestants, prepared food, restricted diet and so on.

Those of us who know the unforeseen difficulties that arise in the removal of an ulcerated gall bladder or of a stone or stones from the common duct, must agree that our endeavor should be to remove them before they cause such evil sequelæ, as suppuration, chronic jaundice, cancer, cirrhosis of the liver and pancreas with, in some instances, diabetes, biliary fistula, and gallstone ileus. The trifling risk of early operation, which consists simply in opening, emptying and draining the gall bladder, is insignificant when compared with the great potential dangers of the disease itself.

It has been well said by Kehr that "it is lamentable that the scientific practitioner well nigh lacks opportunity to influence the masses, but that as soon as he opens his mouth in a society otherwise than medical, he is exposed to the charge of advertising, often, indeed, not without reason. The dangers of cholelithiasis are far too little known amongst the laity; it passes as a harmless disease. Latent cholelithiasis should be regarded dangerous, for gallstones in their quiet work are often most destructive." Operation is not indicated in slight inflammatory processes of the gall bladder. In acute purulent cholecystitis with palpably enlarged gall bladder,

in the absence of diffuse peritonitis, operation is urgent. Perforation of an ulcerated gall bladder, which is tensely distended with pus, with egress of its contents, is not uncommon. That the omentum and surrounding viscera come to the rescue of the threatened peritoneal cavity is no argument against early operation; to the contrary, it is in response to Nature's call for assistance from without. So-called cures from spontaneous evacuation of a gall bladder abscess into the colon are reported by the inexperienced only.

Cholecystostomy for gall bladder lithiasis is rendered more difficult when the stone is lodged in the first part of the sigmoid turn of the cystic duct, and where the gall bladder has formed a diverticulum. Either of these conditions may prevent removal of the stone or stones from the gall bladder and therefore necessitate opening directly into the cystic duct or diverticulum, as the case may be, in which event if repair of these openings impairs the subsequent integrity of the gall bladder, the operation should be that of cholecystectomy.

The treatment of acute calculous cholecystitis in the absence of peritonitis is operation. The treatment of acute calculous cholecystitis in the presence of acute circumscribed and diffuse peritonitis is anatomical and physiological rest, and when the peritonitis has subsided, operation before another attack of cholecystitis occurs. The treatment of acute non-calculous cholecystitis in the presence of tumor and the absence of peritonitis is operation. The treatment of acute non-calculous cholecystitis, in the absence of tumor and the presence of peritonitis, should be anatomical and physiological rest. The treatment of chronic non-calculous cholecystitis should first be medical, when if recurrence occurs—operation. The treatment of carcinoma of the gall bladder, when it is believed to be confined to this organ, is operation.

In hydrops of the gall bladder, cholecystectomy is required, since obliteration of the cystic duct renders the gall bladder not only useless, but a continued menace from the liability of reinfection or even of rupture. Empyema requires cholecystectomy only when of long standing, with the result that the cystic walls are irreparably diseased. If the empyema be acute, drainage of the gall bladder suffices in many cases, and in cases of doubt cholecystostomy is to be preferred to the more serious operation, chole-

cystectomy. Gangrene of the gall bladder naturally requires its excision, and the same is true of perforation, since this latter condition occurs most frequently when the gall bladder walls are extensively diseased. I am convinced that cholecystitis, due to typhoid infection should only exceptionally be operated upon, when in the acute stage.

The non-operative treatment of acute cholecystitis consists in rest in bed, the patient not being allowed to rise to defecate or urinate; application of ice locally, and absolutely nothing by the mouth, not even cracked ice particularly if there is a tendency to nausea. Persistent vomiting to be relieved by washing out the stomach. Nourishment, consisting of normal salt solution and pre-digested beef should be administered by the bowel. Purging or feeding such patients by the mouth—even liquids—since either stimulates peristalsis, which excites pain as well as diffuses sepsis, should not be considered. In cases accompanied by diffuse peritonitis, continuous saline solution by bowel, in addition to the treatment above described, will give the best results. Where the pain is very severe and not controlled by the above treatment, morphia hypodermically or by the bowel is indicated;—but no more should be given than is necessary.

The non-operative treatment of the acute types of non-calculous cholecystitis is the same as above. The non-operative treatment of chronic non-calculous cholecystitis is practically the Carlsbad treatment.

When we regard gall bladder disease in its true light—as a local infection with power to spread and one capable of prompt relief by surgical intervention—operation will not long be delayed until hope has gone and surgery has become but a last resort. It is my opinion, after a rich experience in complicated as well as uncomplicated cases of cholelithiasis, that operation should be resorted to as soon as it is definitely known that gallstones are present. If quiescence and not cure is desired, then medical means are superior to surgical.

In practically all cases of acute infection of the gall bladder there is, as a result, an acute infectious nephritis, the urine showing the presence of albumen, blood, granular and hyaline casts, which always clear up after operation; while if the cases



are allowed to go along until the nephritis becomes chronic then the hope of improvement of the latter condition is rendered fruitless by the serious changes which have taken place in the organ.

Time will not permit me to deal with many of the sequelæ and complications of infections of the gall bladder, any or all of which are sufficiently important to demand serious consideration, and of which I fear many of our profession are neither cognizant, nor even aware of.

In closing I shall briefly touch upon a few of the important points in technique. *Preparation of the Patient:* A sand-pillow is useful to arch the spinal column and give a better exposure to the gall bladder region. Incision is made through the right rectus muscle, and carried well up between the ensiform cartilage and the costal margin. By splitting the rectus muscle, instead of dividing it, a much stronger abdominal wall is secured. Immediately upon opening the peritoneal cavity, in the absence of sepsis, which would be disseminated if present, careful digital examination, to determine as far as possible the pathology and mode of attack, should follow. Where there is risk of infection the surgeon should at once prepare the peritoneal cavity by placing gauze pads, and over these marine sponges, as is my practice, before attacking the enemy. In disposing the gauze and sponges particular care must be given to the subhepatic space and the region above and below the gastro-hepatic omentum. The retention of infected fluid in any of these recesses may give rise to serious consequences later. The marine sponges soak up the fluid better and more quickly than the gauze. The sponges have a two-fold advantage in that they more readily absorb the bile and pus and by reason of their resiliency, act as retractors when the hand of the assistant is placed upon them.

If the field of the gall bladder operation is masked by adhesions these must be carefully loosened and properly dealt with. Adhesions which are very evidently impinging upon and interfering with neighboring organs must be separated. While in some cases a few ligatures and the use of the finger and scissors is sufficient, in others the most extensive and careful dissection is necessary,—careful because of the obscurity of the anatomical landmarks. Every band of adhesion must be carefully tied and divided, and in

separating those which are more voluminous, bleeding must be guarded against by the closest scrutiny. But, on the other hand, adhesions which are doing no damage should not be disturbed. More harm is done in this way than good accomplished, the operation is delayed and the operator often finds himself and his patient in difficulties which a little judgment and restraint would have avoided.

Only so much should be done as is required thoroughly to meet the condition present, especial care being used when acute infection is present. The aim of the surgeon should be to get into the abdominal cavity as quickly as possible, meet the conditions present with the least amount of manipulation, and get out without any unnecessary loss of time.

When infection is present or suspected, upon opening the gall bladder it should be drained. For this purpose I use the commonly employed rubber tube. It is evident to anyone who has done much gall bladder surgery that the appearance of the bile is no certain criterion of its infectiousness. Thick, creamy pus is often sterile, and clear bile may contain virulent organisms. Therefore, even in the presence of apparently normal bile I consider cholecystotomy unwise, and personally do not favor it.

Fistulæ require great caution in management, lest the peritoneum be soiled with bowel contents by inadvertently opening the intestine when cutting a supposed adhesion. These cases call for the expert use of the needle and thread, and require the operator to be the master of all situations and emergencies. The novice at such work may meet with insurmountable difficulties, and leave his patient no better, yes, worse off, than before the operation. The gall bladder should not be removed unless it is so damaged as to render it incapable of functioning as a bile reservoir. If the fundus only is diseased the gall bladder should be resected instead of entirely ablated.

When an infected gall bladder is removed in the presence of jaundice, the stump of the cysticus should be drained, and where this cannot be done, drainage of the hepaticus by means of the choledochus should be instituted, using in either case, a rubber tube. Some assert that after cholecystectomy or cholecystostomy sufficient drainage takes place by way of the choledochus into the

duodenum. But it is much wiser to drain outside of the abdomen than to pour infectious material into another viscus. In drainage of the common duct where difficulty arises in distinguishing between the portal vein and the common duct,—and this sometimes occurs, especially when the portal vein is large and overlaps the outer and anterior border of the common duct,—I puncture the doubtful vessel with a sterile hypodermic needle, in which case withdrawal of blood indicates the vein, and of bile, the duct. The small opening in the vein made by the needle immediately closes. When searching for the common duct remember that the gall bladder and cystic duct hold the same relation to it that the cæcum and the anterior linea coli bears to the vermiform appendix, and that the exposure of the gall bladder and the free border of the gastro-hepatic omentum is the exposure of the field of the common duct.

Ablation of a gall bladder the seat of stones, but otherwise healthy, is indicated when the mucous membrane is embedded with small stones, all of which cannot be removed. It will be readily understood that whenever a single stone remains behind, we take chances on subsequent stone formation.

The only means of determining a patulous cystic duct, before opening the gall bladder, is palpation of the duct for induration of its coats or walls, after division of the peritoneal covering, to see if it is kinked or pouched, and compression of the gall bladder which, if the duct is open, should rapidly empty: the latter method is by far the most reliable.

To my mind the gall bladder if not greatly diseased should not be removed unless the cystic duct is permanently and irretrievably occluded. With few exceptions when the duct is patulous the gall bladder should not be removed in acute catarrhal calculous or non-calculous cholecystitis. Nor even in acute suppurative calculous or non-calculous cholecystitis. But comparatively few cases of chronic calculous or non-calculous cholecystitis indicate ablation, unless hydrops, fibrosis, or calcification of the walls of the organ exist.

I do not believe that the removal of the gall bladder prevents absolutely the recurrence of stone, for we know that stones—though rarely—are formed in the smaller hepatic ducts and in the

common duct. The gall bladder not only acts as a reservoir for the storage of a certain amount of bile, but further as a tension bulb for the biliary passages. (Murphy.) Its removal may be followed by a diverticular formation of either the stump of the cystic duct or of the common duct: this shows how Nature asserts herself when she has been wrongly interfered with. The vis-a-tergo of the bile current has been satisfactorily demonstrated to me by leakage of bile following the throwing off of a ligature placed upon the cystic duct in removal of a functioning gall bladder. On the other hand I have never seen this follow ablation of a gall bladder that had long ceased to functionate; here Nature had accommodated herself to the new situation.

Rarely have I had to remove the gall bladder for external biliary fistula or for traumatic rupture.

This question of cholecystectomy appeals to me strongly, as I fear, from what I read and hear, the practice is all too common, and the influence of this teaching upon those who have not themselves had sufficiently large experience to decide for or against removal, will be bad indeed. My experience is that the more gall bladder surgery I do, the less inclined I am to remove the gall bladder. I will not touch upon the comparative mortality of the two operations, cholecystectomy and cholecystostomy, but will simply say, in passing, that many lives are lost from hæmorrhage, directly or indirectly following removal of the gall bladder, except when done by the surgeon who is most skilful, most dextrous and whose experience in gallstone surgery is very large.

When the gall bladder is removed, apart from the increased immediate danger of infection and hæmorrhage, drainage if indicated must be made through the common duct. When the infection has traveled beyond the gall bladder and involved the hepatic ducts, or if the cystic duct is very much infiltrated, it is my practice not to content myself with drainage of the gall bladder alone, but to drain the common duct as well.

Fistulæ following cholecystostomy should close in a few weeks, and their permanence is due to the continuance of obstruction in the cystic or common duct, either from a stone or stricture, angulation or enlarged lymph node. When the persisting fistula arises from the gall bladder, a plastic operation should be attempted.

Failing by this means, the gall bladder must be isolated, the fistulous opening closed, a cholecysto-duodenostomy performed, or the gall bladder removed; it being understood that the common duct is patulous.

Diseases of the gall bladder, together with other phases of cholelithiasis, have engaged my serious attention for a number of years, and the more I see of these affections the more impressed I am with their importance pathologically, and the more interested and enthusiastic I become in dealing with them surgically. Could I at all times distinguish between calculous and non-calculous cholecystitis I would be happy, because then I would be in a position more safely to advise my patients and give better counsel to those of my colleagues who honor me by calling me in consultation. When this is definitely settled, then, and then only, will we be in a position to say which case can be safely treated medically and which surgically. Until such time is reached I can only advise recourse to the aseptic scalpel as the surest and safest method of relief.

The physician and the surgeon, like twin sisters, must ever work hand in hand each gaining by the advances of the other if we would hope to uncover Nature's recesses.

# **PRACTICAL DEDUCTIONS FROM A SERIES OF OPERATIONS FOR PERFORATED GASTRIC AND DUODENAL ULCER**

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PERFORATION of a gastric or duodenal ulcer has of late years assumed a more and more important place among surgical emergencies. Regarded in the past as a very rare occurrence it has been found to be in fact a not uncommon accident. More exact differentiation of abdominal symptoms and earlier operation for acute intraperitoneal conditions have united to establish the relative frequency of this among the acute surgical lesions in the abdomen. The literature of the past five years contains reports of many cases in which the diagnosis has been made and successful operations performed for this most serious complication of ulcer of the stomach and duodenum. English surgeons particularly report a large number of cases and their estimate of its frequency is higher than that of surgeons of any other country. Lender in Germany estimates that 1 per cent. of all ulcers of the stomach perforate, while Moynihan's estimate for England is 15 to 20 per cent. In actual frequency it cannot of course be compared with such common acute intra-peritoneal lesions as perforative appendicitis, cholecystitis or gall-stone impaction. Nevertheless it comes nowadays into the experience of every active hospital-surgeon and has to be taken into consideration in determining the cause of many of the cases of sudden and severe intra-peritoneal disturbances. Many cases are not recognized and the patient succumbs to peritonitis, or the perforation is walled off and spontaneous recovery occurs.

The frequency as regards the sexes is of interest. There is a general agreement that perforated gastric ulcer is considerably more common in women. Perforated duodenal ulcer is thought to be more common in men. The 14 cases of perforated gastric and duodenal ulcer that I have recorded below were all men. This is probably due to the fact that the hospital in which they were with

one exception operated upon is an emergency one in the down-town section of the city where men are in the great majority. The ages varied from 14 to 61. Ten of the 14 were over 40 years old.

The diagnosis is fortunately easy in a typical case which is seen within the first four to six hours. After that time the symptoms of peritonitis begin to manifest themselves and the origin of the same is obscured. At the outset the clinical picture is very characteristic. The signs of shock, a board-like, retracted abdomen, great pain, tenderness and rigidity in the epigastrium and costal breathing are present. A quiescent period may follow a few hours after the stormy onset and precede the symptoms of peritonitis. The shock passes off and the patient's condition and appearance may improve markedly. The weak pulse becomes stronger, the pain and tenderness may be much less marked and on superficial examination at this time, one may easily conclude that the case is not one of perforated ulcer but of some comparatively trivial intra-abdominal disturbance. The administration of a small dose of morphine is often the cause of this free period and thus helps to obscure the real gravity of the situation. Careful examination will reveal however even in this latent period an abnormal muscular rigidity especially in the epigastrium and this symptom should receive great weight. The pulse rate is also considerably above normal and the blood count shows an increasing leucocytosis. The diagnosis may also be obscured by a history of abdominal injury. The injury may itself have been trivial and have had nothing to do with the perforation. In that case it serves to divert the surgeon's attention away from the real site of the trouble. Thus the history of a blow upon the abdomen followed later by muscular rigidity, vomiting and signs of peritonitis may lead the surgeon to open the abdomen below the umbilicus with the expectation of finding perhaps a ruptured intestine when in reality there may be a perforation of the stomach independent of the trauma. A history of abdominal injury should always be carefully investigated before giving it any weight in the diagnosis of an intra-abdominal lesion. It is possible of course for a blow over the stomach to hasten an impending perforation but such a combination of circumstances must be rare. History of stomach symptoms while not always obtained is important for diagnosis. Occasionally a

definite history of chronic ulcer is given. A history of pre-existing stomach trouble was noted in 8 of the 14 cases recorded below. Repeated questioning gave no clue to either ulcer or gastritis.

There are a number of conditions which can cause symptoms like those of perforated gastric ulcer. Only by careful weighing of each sign can the error be avoided. Sudden severe epigastric pain is a necessary accompaniment of perforation, but not sufficient to make the diagnosis. With the pain go collapse, extreme muscular rigidity and tenderness over the stomach; later, the signs of developing peritonitis. Intense pain alone can be caused by appendicitis, gall-stones, acute gastritis, etc. I recently saw a case which gave a history of sudden tearing pain in the epigastrium following an attack of vomiting. The patient, a man of 50, was brought to the hospital 24 hours later with a temperature of  $101.6^{\circ}$ , pulse 120 and leucocyte count of 22,000 with 85 per cent. polynuclears. There was marked tenderness and some rigidity in the epigastrium but none over the rest of the abdomen. The clinical picture resembled that of perforated gastric ulcer with the exception that the typical board-like rigidity of the abdominal muscles was wanting. The subsequent course of the case showed it to be one of acute alcoholic gastritis. The diaphragmatic pleurisy associated with a beginning pneumonia may cause a sudden pain in the epigastrium which with the fever and possibly vomiting may lead one to a diagnosis of perforated ulcer. The tenderness, however, is not so marked, the muscular rigidity not of a board-like character and there are usually signs pointing to the lungs. An acute appendicitis may begin with epigastric pain but the latter is not so sudden nor so intense and changes later to the right iliac fossa. Here too the muscular rigidity in the epigastric region has not the same board-like character as in perforated ulcer. Acute pancreatitis bears probably the greatest resemblance to this condition. There is the same sudden onset of pain with collapse combined with epigastric tenderness. In place of a retracted abdomen, however, as in ulcer, there is usually a fulness in the epigastrium. Symptoms like those of intestinal obstruction soon become prominent.

The prognosis of operative treatment of perforated gastric ulcer has shown a great improvement in the last decade. This is due chiefly to the fact that the condition has been recognized earlier.



Körte operated on 10 cases from 1890 to 1900 with a mortality of 90 per cent. These cases all came to him at a late stage with well developed peritonitis. From 1900 to 1907 he operated on 17 cases by laparotomy and suture with a mortality of only 23.5 per cent. These cases as a rule were diagnosed at a much earlier period before the development of a general peritonitis. Cases that are operated on within the first eight to ten hours should have as a rule a relatively good prognosis. Since the stomach contents are not particularly infectious, considerable time may elapse before the development of a peritonitis. One is often surprised on opening the abdomen several hours after perforation to find only a mild reaction on the part of the peritoneum with only slight distension and exudation. One is struck with the contrast in this respect with perforative lesions lower down in the intestinal tract. Though it develops slowly the peritonitis has none the less a fatal outcome and after 12 hours the majority of the cases can no longer be saved. After 24 hours only isolated cases will recover while those operated upon after 48 hours are almost certainly doomed. In this series 8 were operated on within 12 hours. Five recovered—a mortality of 37.5 per cent. Six cases were operated on 12–72 hours after perforation. Of these, 2 recovered, a mortality of 66 per cent.

Besides the question of time other factors enter into the prognosis. The *size* of the perforation determines to some extent the rapidity of development of the peritonitis. A small opening which allows only a limited amount of fluid contents to escape perhaps intermittently will produce a peritonitis much more slowly than a large opening which floods the peritoneal cavity with solid as well as fluid contents. Furthermore, the condition of the stomach whether filled or empty is of importance. The gastric secretion alone is comparatively sterile and hence its escape from an empty stomach produces but little reaction. On the other hand the material from a full stomach is necessarily more infectious and the solid particles if allowed to remain after flushing of the abdomen tend to keep up the inflammation. We should not fail to recognize that another factor that has favorably influenced the prognosis of operations for perforated gastric ulcer is the improved technic in treating general peritonitis. The last decade has seen, with the introduction of more scientific and simpler methods of operative

treatment, a remarkable reduction in the mortality of general peritonitis. Even the advanced cases with involvement of the major part of the peritoneal surface may be saved by present methods, which before were uniformly lost. We must not only operate early but also according to improved methods. Even those operated upon within the first few hours can be lost by prolonging the operative procedures, unnecessary exposing and handling of the intestines, careless after treatment, etc.

The treatment of perforated gastric ulcer should be prompt. The earlier the patient is brought to the operating table the better the outlook. It is seldom necessary to wait for recovery from the initial shock. This is usually over by the time that the preparations for the operation have been completed. To wait for complete reaction would involve more risk than that from increased shock due to the operation. After the diagnosis has been made, a hypodermic injection of morphine is a good preparation for the general anaesthesia. Precautions should be taken in susceptible subjects particularly the old and alcoholic to prevent pneumonia. The mouth and teeth should be thoroughly cleansed. The ether should be given cautiously and any regurgitation prevented.

The operative procedures should be short and simple. All the manipulations can be done satisfactorily through an incision 3 to 4 inches long in the median line above the umbilicus. There need be no handling of intestines nor evisceration. The perforation is found in the great majority of cases on the anterior wall of the stomach near the pylorus and is easily exposed by raising the liver and drawing the stomach forward into the wound. The presence of lymph flakes is a good guide to the seat of the trouble. The opening is usually small, sharply defined, punched out in appearance and there is more or less induration of the edges. A satisfactory closure can usually be made with silk sutures in the form of a purse string or one or more rows of Lembert's. In this way the edges are turned in. It is usually not necessary to excise the indurated margins nor does it seem advisable when simple suture is so effectual. Covering the line of suture with a portion of omentum is an excellent expedient for preventing extravasation in case the sutures give way. It has even been used successfully as a substitute for suture, where the latter was impracticable.

The addition of a gastro-enterostomy as advocated by some surgeons is not necessary in the great majority of cases and prolongs undesirably the operation. When, however, there are distinct signs of pyloric obstruction present or the latter is to be feared on account of the infolding and suturing of the edges of the ulcer, a gastro-enterostomy may be indicated. Without such indications it is undesirable to prolong the operation by any such time-consuming procedure. In one of my cases there was an associated carcinoma of the pylorus with dilatation of the stomach and secondary nodules in the liver, and a posterior gastro-enterostomy was done.

The perforation having been closed, it is desirable to cleanse the peritoneal cavity of exudate and possible stomach contents. When the exudate is confined to the upper part of the abdomen as in the cases operated upon early, it can be removed by sponging. The upper and lower surfaces of the liver and the right kidney pouch should be cleansed with special care. When the exudate is general and fills the pelvis, flushing of the abdominal cavity with large amounts of saline solution is advisable. This can be done very satisfactorily with a Blake's tube which is introduced into different parts of the cavity until the solution returns clear. Indiscriminate irrigation of the abdominal cavity is probably harmful in some cases as the infectious material is disseminated. The intra-abdominal manipulations should not be unnecessarily prolonged.

Drainage is largely a matter of individual preference. Many surgeons, Körte for instance, do not employ any drainage. Others drain not only the site of the perforation but also the pelvis by means of a separate incision above the pubes. A middle course seems to me the most desirable. A small cigarette-drain passed down to the line of suture in the stomach provides a satisfactory escape for any infectious material left in the neighborhood and in case the suture gives way, furnishes an outlet for escaping stomach contents. Such a drain does no harm and may be of great service. Separate drainage of the pelvis is not necessary in the majority of cases. The exudate which has gravitated there has, in case saline irrigation is employed, been sufficiently diluted to be innocuous.

In the after treatment it is desirable to withhold nourishment by mouth for four or five days. Rectal feeding combined with

TABLE I.

Case No.	Previous History.	Time elapsed before Operation.	Location of Perforation.	Procedure.	Drainage.	Complications besides Peritonitis.	Result.
M 45	Not obtained.	24 hours	Duodenum second portion.	Suture and omental covering.	Yes	.....	Died.
M* 61	Negative.	10 hours	Ant. wall of stomach 1½ inches from pylorus.	Suture and omental covering.	Yes	Pneumonia—Parotitis.	Operation recovery. Fatal pneumonia six weeks later.
M* 14	Negative.	6 hours	Stomach ant. wall 1½-2 inches from pylorus.	Suture and omental covering.	Yes	.....	Recovery.
M* 43	History of gastritis for number of years.	10 hours	Stomach ant. wall near pylorus.	Suture.	Yes	Delirium tremens.	Died.
M* 42	History of ulcer.	3 hours	Stomach ant. wall 6 inches from pylorus.	Excision and suture.	Yes	Pneumonia.	Recovery.
M* 58	History of gastritis and loss of weight.	72 hours	Stomach ant. wall, 2 inches from pylorus.	Suture gastro-enterostomy.	Yes	Carcinoma of pylorus, metastases in liver, empyema.	Died three weeks after operation.
M* 26	History of gastritis.	24 hours	Duodenum.	Gauze packing without suture.	Yes	.....	Recovery.
M 54	Short history of gastritis.	12 hours	Stomach ant. wall near pylorus.	Suture and omental covering.	Yes	.....	Recovery.
M 23	History of mild gastric disorder.	3 hours	Stomach ant. wall just above pylorus.	Suture.	Yes	.....	Recovery.
M* 34	History of gastritis.	8 hours	Stomach anterior wall above pylorus.	Suture.	Yes	Pneumonia and parotitis.	Died.
M 45	Not obtained.	24 hours	Stomach ant. wall near pylorus.	Suture.	Yes	.....	Died.
M 45	History of gastritis for past year.	6 hours	Duodenum, first portion.	Suture.	Yes	.....	Recovery.
M 45	Negative.	48 hours	Duodenum, first portion.	Suture and omental covering.	Yes	.....	Died.
M* 42	No history.	48 hours	Stomach near pylorus ant. wall.	Suture and omental covering.	Yes	.....	Recovery.

\* Personal cases.

high irrigation of normal salt solution are indicated. If the patient is much reduced it may be necessary to resort to fluids by mouth soon after the operation. Pneumonia and parotitis should be guarded against, particularly in the alcoholic, by careful cleansing of the mouth and teeth. A half-sitting posture should be assumed at an early period so as to prevent hypostatic pneumonia.

The operative results are encouraging although the mortality is still high if we take all cases together. Many cases are still brought to the hospital with a fully developed peritonitis. Others are very unfavorable subjects, particularly the alcoholic. The statistics will therefore vary according to the class of patients dealt with. Among the higher classes the mortality will naturally be much lower than among the poorer patients who do not receive such prompt medical attention and who are, in the cases of the males, so frequently alcoholic. The series that I have collected from the hospital records belong in the latter class and the mortality is hence fairly high, viz., 50 per cent. Moynihan reports 12 cases also with a mortality of 50 per cent. Caird operated on 25 cases with a mortality of 36 per cent. Körte's series of 17 cases showed 23.5 per cent. mortality, the lowest that I have been able to find.

The 14 cases described (page 111, Table I) were operated on with one exception in one hospital from 1904 to 1907, and are the only ones that have come under my observation. If we include among the successful cases the one in which a fatal pneumonia occurred six weeks after the operation and two weeks after the patient had begun to walk about the ward, the mortality of the series is 42.8 per cent.

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## RESECTION OF THE SHOULDER JOINT FOR SUPPURATIVE DISEASE OF THE BONE \*

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GENTLEMEN: The patient to be brought before us presently is an elderly colored woman referred to me by Prof. S. E. Woody, with the following history: Some time last summer she received an injury to the right shoulder joint. She took it to be but a slight injury, and in proof of this she settled a damage suit with the street railway company for the small sum of eighteen dollars,—a few weeks's wages. She was able to work for several weeks after the accident. Later, however, she developed an enlargement at the inner anterior aspect of the humerus below the shoulder joint, which was rather firm at first but finally became softer and broke down. She applied for treatment at the Louisville City Hospital on account of this trouble which developed as a result, probably, of the injury sustained, or at least became apparent soon after the accident, and remained there for several weeks. An abscess formed which had to be incised. This was done at the City Hospital. She did indifferently well for a time, and finally Prof. Woody made a counter-incision in the axillary region for drainage, and inserted a drainage-tube through the joint. He tells me that from his examination he became convinced that there was more or less erosion of the articular surfaces of the joint. Of course the exact pathology cannot be given you because I have made no exploration of the joint with my finger; in fact, have made but a superficial examination of the patient.

We expect this morning to make a thorough exploration under chloroform, and will resort to whatever surgical intervention we may find necessary after our examination. The probability is that there has been suppurative disease of the bone, or at least of the

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\* Clinical lecture delivered at the University of Louisville, Medical Department.

joint, as a result of infection, and that there has been erosion of the bony articulation. If we find this to be true, the most appropriate treatment would be excision of the head of the humerus. My experience has been that under such circumstances healing is more prompt after the head of the humerus has been excised than if you leave the head intact and hope to have the parts heal. In fact, with the head of the bone *in situ* we are likely to get a stiff joint, after extensive suppurative inflammation of the shoulder joint, which has recovered by reason of the through-drainage treatment. If you remove the head of the bone you necessarily weaken the strength of the arm, but you increase the mobility. It is remarkable oftentimes how much mobility is found to exist after resection of the head of the humerus, and this is a factor which is very important in connection with this joint. The patient can manage very much better the fixed hip or fixed knee than a fixed shoulder. Function is greatly embarrassed when you have fixation of the shoulder, the reason being that this is a very movable joint,—in fact, the most movable joint in the entire body.

Excision of the head of the humerus may be accomplished by a number of incisions; the one most commonly in use is that of Langenbeck, which is a straight incision down the anterior portion of the arm, running from the top of the shoulder down parallel with the bicipital groove and a little external to it. The incision is best made down to the bone through the periosteum, then the periosteum can be lifted up and the operation completed to some extent subperiosteally. It is best to lift off the biceps tendon with the periosteum lining the bicipital groove, and then to retract the tendon to whichever side may be most convenient. You will probably find that in most cases the inner side will be preferable. The bone is then rotated outward, and the attachment of the subscapular to the lesser tuberosity is separated from the bone either by excision or by pushing it off with a periosteal elevator. The bone is then rotated inward and the muscles separated from the greater tuberosity. If in accomplishing this the capsule is cut away from its attachment to the scapula, you will find the capsule can be separated sufficiently to allow the head of the bone to protrude. It is not always necessary to get the head of the bone entirely out of the cavity, because with the Gigli saw it is possible to remove the head

of the humerus without such extensive manipulation. This saw consists of small steel wire which is passed in behind the neck of the bone and held by the two handles in front. In this way you can saw off the head of the bone without damage to the brachial or axillary vessels and remove the fragment.

The section of the bone is made just above, or at any point above, the attachment of the *teres major* and *latissimus dorsi* muscles, between that point and the head, through the surgical neck of the humerus. In some cases it will be found necessary to make the section of the bone some distance down the shaft. I remember the case of a little boy who sustained a fall with only slight injury, where there later developed tuberculosis of the humerus; and by the way, this is a joint which is rarely attacked by tuberculosis. This child had almost half the shaft of the humerus removed; and when you remove the extremity of the bone in the young you must remember that the bone does not grow in length in the same proportion that it does in the adult; in other words, when you take off the extremity of the bone you get rid of the center which produces lengthening of the bone. In the case of the little boy referred to, we found it necessary to remove a considerable portion of the shaft, and therefore we hoped for very little reproduction of the bone in length. We found, however, that there was reproduction of the bone even near the upper extremity, the operation being done as nearly subperiosteally as was possible. We found also that there was a tendency of the upper fragment to be pointed, a condition which may occur, and at the point where these two fragments joined there was a false joint. An operation could be done to restore union of these two fragments, and in that way lengthen the humerus. This would not seem advisable, however, as he has very good use of his arm. He has perfect function with the exception that the arm is about three inches shorter than the one on the opposite side. Strange as it may seem, however, this fact is hardly noticeable without actual measurement. It is remarkable even after an operation of this kind how little deformity is noticeable.

If we find that the woman we shall presently operate upon, has a condition similar to that of the boy just mentioned, operation will be attempted in the same way. We can explore the bone through the opening already present, and may be able to complete the opera-



tion through this opening, or in the site of the old incision; but I am inclined to the belief that we will have to make an incision a little further to the outside than the one already present, because that incision lies close in toward the large blood vessels which we wish to avoid. After excision the wound is treated with a drain and the opening kept patent until suppuration has entirely ceased. Of course we will wash out the wound thoroughly, as well as the cavity of the joint, getting rid of the synovial membrane and the diseased tissue in the shaft of the humerus and in the scapula as well.

In tuberculosis of the joint structures, the condition usually attacks the bone first, or I should say the epiphyses of the bone; from that point it spreads into the joint usually through the defect in the cartilage covering the joint, or through the groove near the cartilage where the bone is covered by the capsule. About one-third of the cases are first synovial, and two-thirds primarily osteal tuberculosis. In any event, as soon as the joint structures are involved you have a diseased synovial membrane, and find slight development of granulation tissue springing from this synovial membrane, until eventually the entire joint may be covered or filled with granulation tissue. Along with this you may have a certain amount of serum poured out into the joint. Under these circumstances the joint may be markedly swollen and distended. In other instances you may have simply gelatinous granulations without a large amount of fluid. It is remarkable what a small amount of fluid may be present in some cases similar otherwise in type, resembling the *caries sicca* of tuberculous bone disease. As the process continues you will find that the capsule becomes more or less softened, thinned, and finally perforation of the capsule takes place, and this is especially likely to occur where you have a mixed infection of pyogenic bacteria and the tubercle bacillus. When this thinning of the capsule occurs rupture may take place into the surrounding tissues, and you have an abscess of the so-called cold type which may finally rupture spontaneously. If it is a mixed infection the abscess takes on an acute form, and you have acute suppuration, and this may be the first thing to call attention of the patient to the fact that the joint has been diseased. But if attention is called to the matter, the surgeon should be able to

make his diagnosis long before the joint disease has gone to the point of rupture and material from the abscess has been extravasated into the surrounding tissues.

If there is a mixed infection, and rupture occurs into the cellular tissue toward the surface of the body, or if it is a tuberculous infection and rupture occurs to the surface of the body, then you will have mixed infection and your patient will likely die of septic intoxication, or septic infection,—what was formerly described as an acute type of so-called hectic fever, with high elevation of temperature, profuse sweats, gradual emaciation, prostration, and finally death from exhaustion. This is the way these cases of tuberculous joint disease terminate after the abscess, as I have described it, has either opened spontaneously or has been incised by the surgeon. It is an exceedingly difficult thing to keep an old or a recent discharging abscess, from a tubercular joint, from becoming infected with the pyogenic bacteria,—the streptococcus, the staphylococcus, etc. When any of these germs of suppuration become engrafted upon an existing infection by the tubercle bacillus, you will find that the patient always runs great risk of losing his life.

The symptoms of joint tuberculosis are: (1) loss of function, (2) pain, which may not be referred to the joint itself but away from the affected joint. If the hip is diseased pain may be referred along the obturator nerve down the thigh, and especially to the knee. You will remember the nerve supply to the hip, thigh, and as far down as the knee, takes its origin from the obturator nerve trunk. This is one peculiar characteristic of hip joint disease of tuberculous type, that the patient will complain most frequently of pain at the knee rather than at the hip. This is not true, however, of the shoulder joint, pain being always in this case referred to the joint itself. One of the first symptoms of tuberculosis of either the hip or shoulder joint is partial disability. In the hip you will find a slight limp, the patient in attempting to stoop will do so with the affected limb in full extension,—he will not flex the hip joint because of the pain which it causes him. In the shoulder you will always find impairment of motion of the joint. The patient at first has slight pain on certain movements of the humeral head; this gradually increases until pain becomes quite marked. The shape of the joint is somewhat characteristic. In the knee and the ankle,

which are joints more frequently attacked by tuberculosis than is the shoulder, you will find the swelling is spindle-shaped, thicker in the center and tapering off toward the shaft of the femur and toward the ankle. This spindle-shaped deformity is seen in its most typical form at the knee, but at the shoulder joint the deformity is globular. This is probably due, to some extent, to the shape of the joint when distended, partially also to the lack of use of the arm, for the muscles begin to atrophy both above and below. When the knee is involved the swelling is especially spindle-shaped, it begins to broaden near the knee joint, the muscles atrophy above and below, and you have a distinct spindle-shape.

With or without the history of injury, with an obscure pain in the joint which does not disappear under the ordinary antirheumatic or antispasmodic remedies, with a globular swelling, with a swelling which feels semifluid, gelatinous to the touch, with interference of motion, and above all a lessening in size of the limb from atrophy of the muscles, you can almost definitely make the diagnosis of tuberculosis of the joint. The development of a limp in the hip joint is one of the most characteristic symptoms upon which to base your diagnosis. Deformity and attitude are also important diagnostic points.

A tuberculous lesion of the joint may assume an acute form. As a rule, however, it runs a chronic course, and the natural tendency of tuberculous lesions of the joint, if the joint is put at rest, is toward recovery. Many of these cases get well, and the patient later, at the age of thirty or thirty-five years, succumbs to tuberculosis of the lungs. These cases of joint tuberculosis usually occur in young people; and we might say the tuberculous process is simply checked at one place, and that later it attacks the lung and the patient dies as a result; but generally, when the patient is young and the condition is properly cared for, the tendency is towards recovery. If the case has an acute beginning, for instance, an acute tuberculosis of the hip joint, you may find it difficult to check the progress of the infection. If there is a mixed infection, you will find that breaking down of the joint structure will occur, pain will be very great, the patient soon becomes exhausted, and unless promptly relieved by surgical procedures will probably lose his life.

The acute inflammations of bone are generally due to infection with the pyogenic bacteria; they run a more rapid course. If the patient is a child, which is the rule, there will usually be a history that the child has been sitting out of doors in the cold; it goes to bed apparently well, and wakes up in the night with acute pain, is seized with a severe chill, followed by a high range of temperature, the pain increasing in severity. When the physician is called he will probably diagnose acute rheumatism. The most misleading thing in the world is this condition of acute osteo-myelitis. Especially if it occurs in the epiphyseal end of the bone is it likely to be mistaken for rheumatism; hence the case does not receive the treatment that should be employed early in the attack.

The process here is like inflammation of the bone elsewhere: you have first dilatation of the blood vessels, with soon an infiltration of the tissues which is extensive owing to the presence of the pyogenic bacteria. These bacteria multiply very rapidly, so rapidly in fact that they entirely destroy the integrity of the bone within twenty-four hours in many instances. The bone is found later as a dead sequestrum. Owing to resistance of the surrounding tissues absorption is great and systemic effect marked. You will remember that when pus forms it is held in closely by the surrounding tissues which induces prompt absorption and rapid extension. If, however, there is but a small quantity of pus, and this forms late in the disease, there is frequently less absorption, less extension, and also less tendency to necrosis. In cases of acute osteo-myelitis you will find the process runs a very rapid course, some patients dying before the diagnosis is made; in fact, inside of forty-eight hours from the beginning of the attack.

As to treatment of these conditions: Of course the method depends largely upon whether the disease is acute or chronic in character. The best treatment at the present day for tuberculosis of bone, is known as the Bier method, which consists in the application of an apparatus for the production of congestion of the part to stimulate the activity of the cells. Bier found that by constricting the limb, or by applying a suction apparatus to the part infected with tuberculosis, that he produced a passive hyperæmia. In the presence of this hyperæmia the tubercle bacillus cannot live. This is illustrated in cases of fracture. The rarest thing in the

world is to find a tuberculous process engrafted upon the tissues involved in a fracture. During the process of repair a greater amount of blood goes to the part, cell proliferation is marked, and if the tubercle bacilli are introduced at that time they are promptly destroyed by the phagocytes. So that we very seldom have tuberculosis in the presence of the active process of repair, and Bier has advised the use of this method to produce hyperæmia by sending an increased amount of blood to the affected part. I believe this is the best treatment. We may, however, apply a plaster of Paris bandage and obtain complete rest of the part for a prolonged period of time. In this way we can sometimes secure favorable results.

In the more acute processes, however, if you are called immediately after the patient has had a sudden chill, pain in the extremity of the bone, with tenderness over a localized area on pressure, the best thing to do is to take the actual cautery and introduce it directly into the bone. This is done not with the idea of completely destroying the bacteria which may be present, but more to make an opening in the bone for exit of the fluid from the infected area, so that the extravasation from the blood vessels may escape, and thus relieve the tension. You might ask, why do this with a hot iron? Because the hot iron seals and closes the blood vessels through which it may be passed, and in this way prevents absorption of the inflammatory material into the open ends of the blood vessels.

The best treatment, then, for acute cases would be puncture,—it is called igni-puncture. If this fails you still have recourse to the open operation with thorough removal of all broken down bone, including the focus of infection. This should be done if possible before the end of thirty-six hours. Of course it is possible that you may be able to make a diagnosis and operate earlier than this, but as a rule you will not. If the process is very acute I would not hesitate to make a free opening, clean out the diseased tissues thoroughly and attempt to get rid of the infection promptly in this way. In order to sterilize the bone cavity which you have opened, the best thing in the world is pure carbolic acid. For many years the profession knew nothing of the effect of alcohol upon carbolic acid, and yet it has been in use for the past ten or more years. Alcohol will absolutely arrest the caustic action of carbolic acid if applied

and then washed off; but if you apply carbolic acid, then alcohol, and do not wash away the latter, the alcohol evaporates and you have continuation of the effect of the carbolic acid. Where carbolic acid and alcohol are used in the manner indicated, you need have no fear of harm being done. Carbolic acid will also destroy bacteria in the superficial tissues, and it is one of the best agents of which I have knowledge for sterilizing bone.

You see here the drainage tube through the shoulder joint. You must remember in operating in this region that we are near the brachial and axillary blood vessels. As the patient is now profoundly under the influence of the anæsthetic, we will make a careful examination to ascertain if possible just the conditions with which we have to deal. As I move the joint I can plainly detect a grating sensation, indicating that there is an erosion of the joint structures. We make a free incision through the deltoid muscle down to the bone, opening the shoulder joint in the manner described a few moments ago. If any small blood vessels are severed in making our incision we will catch and twist them with hæmostats, thus preventing hæmorrhage as well as possible. We could make this almost a bloodless operation by using pins above the shoulder, but ordinarily such a procedure is found unnecessary, as the bleeding can be easily controlled. We are having a little more hæmorrhage than is usual in such an operation, because of the friability of the tissues; we apply a small hæmostat to a bleeding point, and oftentimes it will not hold, the tissues being so friable that it immediately tears out. We cut down to the periosteum which will be split and separated from the bone and turned back so as to make the operation as nearly as possible subperiosteal. You must remember that the biceps tendon extends into the joint structure, and must be pushed aside. The joint is now open, and with my finger I can feel the head of the humerus, which is partly bare. There is a pus cavity in the bone. After further dissection of the soft tissues we find that there is a pocket of pus extending some distance downward in the deltoid muscle. I think this woman must have had an acute infection of the joint; at her age, everything being considered, I take it to be an acute or subacute infection, in contradistinction to tuberculosis of the joint.

Having separated the muscle attached to the greater tuberosity,

we will free the head of the bone and remove it. The attachment of the subscapularis must be separated and then the head of the bone will be free. As there appears to be extensive disease of the bone, we will clean out the canal as far as we can. It is possible to remove almost the entire shaft of the humerus, but in an old person it is not advisable, as repair would be slow and function greatly impaired. At her age amputation of the arm would result in a more prompt recovery and is worthy of consideration. If she were a younger woman of course I would not consider amputation. However, this woman is in good general health, and we will save the arm if we can do so without danger to life.

After having entirely freed the end of the humerus a strange condition develops, an oblique separation of the bone into two parts, which makes us ask whether there was a fracture of the humerus in the beginning or not; there is certainly every appearance of an oblique fracture now, but there is no evidence of any callus formation. We find it is necessary to remove about half the humerus, as it is badly splintered and comes away in pieces. The head of the bone shows evidence of suppurative disease,—the bone is denuded, rough, and badly eroded, and the medullary canal is full of pus. There appears to be no disease in the scapula. The pieces of humerus removed, you will observe, are like sequestra following an old fracture.

Owing to the fact that the humerus was in two fragments, we have not used the Gigli saw; in fact, it could not well have been utilized under the circumstances. We have removed all the fragments of bone with forceps, and by means of pliers have broken away the remaining splinters until we have a comparatively even bony surface. As the canal remaining appears to be in fair condition, I will not use carbolic acid, but will introduce a strip of plain sterile gauze down into the canal. Of course we could use iodoform gauze for this purpose, but it would be less effective for drainage purposes, and of little practical value.

We have done nothing with the old drainage wounds, preferring to let them heal by granulation, and it is unnecessary to increase the raw surface for infection. We pack the fresh wound with gauze, as there is still slight oozing, and apply the customary dressing for this class of cases.

# THE IMPORT OF DIGESTIVE DISTURBANCES IN THE DIAGNOSIS OF SURGICAL LESIONS OF THE ABDOMEN

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It would appear that even modern medical men have been rather slow in recognizing the significance of perverted gastric function, and the phenomena thereby induced, in connection with the diagnosis of surgical lesions of the upper abdomen. Patients exhibiting symptoms referable to the digestive tract are still relegated to the ever-growing list of dyspeptics, neurasthenics, etc.; and the latter proposition is so frequently true that it is unsafe to accept the diagnosis which may have been made by the physician based upon his consideration of the gastric manifestations present. The symptoms must be accorded careful scrutiny by the surgeon, in connection with the attending physician, in relation to the probable existing pathology, and as influencing factors which shall govern medical or surgical treatment.

Personally I do not believe functional disturbance of the stomach ever exists as a distinct entity, experience having convinced me that organic lesions either in this viscus or in adjacent organs are accountable for practically all the cases of so-called functional gastric disease of more than temporary duration. It is not my purpose, however, to discuss at length either gastric disorders or gastric surgery, but briefly to direct attention to a few of the organic lesions oftentimes inducing a symptom complex which may easily be erroneously attributed to gastric disease as the primary causative factor. The terms indigestion and so-called dyspepsia are frequently abused and certainly much misused. On account of the nerve distribution to the abdominal cavity and the coördination of function of the intestinal glands and the alimentary tract, acute or even chronic disease of any of the abdominal



contents without more or less gastric disturbance is an exceedingly uncommon occurrence.

The region of the abdomen most frequently involved in serious organic disease is the right side, the structures usually affected being the gall bladder, the kidneys, and the appendix ceci vermiciformis. A lesion in any of these organs will more than likely be accompanied by gastric symptoms, and the more chronic the disease the more significant, or at least the more prominent, may become the gastric reflex phenomena, such as vomiting, pain, tympany, diarrhoea, etc. Upon the time that these various symptoms become manifest with relation to the ingestion of food, and upon their character and duration taken in connection with other phenomena elicited by thorough physical examination, our opinion as to diagnosis and decision as to the wisdom of operative intervention in a given case must be based.

Biliary calculi and other diseases involving the gall bladder and liver are not infrequently confused with so-called dyspepsia, gastric ulcer, and even gastric cancer. Diagnostic errors are common and the cause is not far to seek. Too much importance has been accorded the unreliable symptom of jaundice as pathognomonic of gall bladder disease. Usually one of the first things said by the patient, and it is not an infrequent expression of the attending physician, after a diagnosis of gall bladder disease has been made, is: "Why, doctor, there has never been any jaundice!" As a matter of fact this symptom is present in only one out of every ten cases of gall stones. Jaundice simply indicates obstruction to the passage of bile from the hepatic duct into the gall bladder, which is not always due to the presence of calculi, to common duct obstruction, or disease of the gall bladder.

As already suggested the most characteristic phenomena usually present in gall bladder disease are symptoms referable to the stomach, consequently this organ most frequently receives the credit and likewise the medication. Of course by careful inquiry and competent analysis these cases can be easily explained. However, it must be borne in mind that differentiation may be quite impossible at times between disease of the gall bladder and its ducts, peri-cholecystitis, and gall stones if they be present. When we remember the intimate relationship between the pylorus and

the bile passages, the bowel adjacent to the gall bladder and the stomach, and that biliary disease is primarily inflammatory and liable to penetrate beyond the confines of its inception, is such an error greatly to be wondered at?

Ordinarily in an average case of gall stones it will be ascertained that pain begins shortly after the ingestion of food; that it is cramp-like over the epigastric region radiating to the back along the rib line, often passing upward toward the right shoulder. If the patient vomits, pain ceases shortly thereafter. Even if there be present no jaundice and we find absence of tenderness over the lumbar ganglia (Morris), with increased sensibility and pronounced rigidity midway between the umbilicus and the ninth costal cartilage, the diagnosis of gall stones seems reasonably clear. Chemical examination of the products of stomach washing will usually help to exclude a gastric cause of the phenomena, though there may exist as a complication, firm adhesions involving the stomach, with attending pyloric obstruction, and resultant dilatation inducing chemical and other diagnostic signs of gastric disease.

With respect to renal reflexes in relation to the stomach and intestine, my observation is that not only surgical but medical kidney lesions are oftentimes treated as instances of stomach and intestinal disorders. I have recently had under observation a patient suffering from a mild type of pyelitis who had been treated several weeks by an excellent practitioner for intestinal indigestion, the gastric crisis which so often ushers in an attack of pyelitis having been completely misinterpreted. The patient first complained of pain in the abdomen, distension from gas, nausea, vomiting, then later diarrhoea. Rest in bed, a purge and restricted diet, would afford relief for a time; but the attack would recur in the course of a week or ten days. Physical examination revealed a tender movable kidney on the right side, and urinalysis disclosed pus which ureteral catheterization demonstrated as coming from the right kidney. Ignoring the gastric symptoms and irrigating the kidney pelvis, so to speak, by administration of urotropin with large quantities of water quickly dissipated all the manifestations; the indigestion likewise rapidly disappeared. Not only may pyelitis and other gross lesions of the kidney give rise to such error,

but not infrequently it is found that movable kidney alone will apparently induce the most marked reflexes, or at least be a factor in the production of what appears to be extensive pathological change about the stomach or intestines.

Inability of the stomach to empty itself completely because of acute angulation due to dragging on the pylorus; diarrhoea the result of circulatory and mechanical interference with the bowel and its secretion; congestion of the appendix and the reflexes incident thereto,—all produced by mobility and more or less constant displacement of the kidney,—are sometimes the direct cause of the clinical picture presented. A correct diagnosis, therefore, can only be reached after careful and painstaking physical examination. This having been done replacement of the kidney by proper methods of procedure will confirm the diagnosis by prompt relief of all the gastric manifestations.

Next to biliary and renal disease I feel certain that acute and chronic lesions of the vermiform appendix are most often mistaken for digestive disturbances. The number of cases of acute appendicitis thus diagnosticated and treated can only be surmised, but probably seventy to seventy-five per cent of primary attacks would represent the average, *i.e.*, the first attack is looked upon as acute indigestion, treated by a purge and restricted diet for a few days usually followed by apparent cure. Probably several recurrences are similarly diagnosticated and treated, and when finally the worst attack supervenes the patient almost reaches death's door before a correct diagnosis is made,—and why? Because the seizure was considered nothing more than one of the patient's usual "dyspeptic" attacks until the family become alarmed on account of the desperate condition which develops. In chronic appendicitis where there is more or less pain and discomfort at all times, and where adhesions are present with involution or partial obliteration of the appendix, the patient is not infrequently dosed with medicine for months, has his stomach irrigated, and is purged and dieted, under the impression that the stomach and intestines are at fault! These are not fanciful pictures, nor are they in the least exaggerated.

If patients suffering with chronic disease were put to bed, the abdomen exposed and carefully palpated, a correct diagnosis could

be made; but so long as we see these patients in the office and continue to examine them simply by questioning, which is often suggestive in its character, just so long will errors continue to be made in proper interpretation of the manifestations based upon the symptomatology present.

Pain upon pressure over the right lumbar ganglion (Morris) is a valuable sign in chronic appendiceal disease; there is always rigidity though it may not be marked in the right iliac fossa; there is also tenderness in this region. The enlarged or painful appendix can usually be palpated, and such manipulation gives rise to the characteristic pain which is commonly complained of during the patient's attack of so-called dyspepsia.

As already indicated, strange as it may seem acute appendicitis is also often wrongly diagnosticated: If it be remembered that pain almost always precedes vomiting, if we search for and locate rigidity and tenderness in the right iliac fossa,—and if this symptom complex develop in an individual who has previously enjoyed good health,—there should be no difficulty in making the diagnosis.

Do not wait for tumor formation, and do not be misled by the fact that there exists no decided elevation of temperature. A classical attack of acute appendicitis so closely resembles what some of the text books describe as "acute indigestion" as to be almost its twin brother. Look suspiciously upon every case of this character. Whenever there are present the characteristic iliac fossa symptoms, it may be stated almost absolutely that the trouble is located in the vermiform appendix.

# Gynæcology

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## ON FIXATION ABSCESES

BY JULES THIROLOIX, M.D.

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THE following case, which occurred recently in my wards at St. Antoine hospital, has afforded me the opportunity of going into the details of artificial aseptic pyogenesis as a therapeutic means for treating septicæmia, and puerperal septicæmia in particular,—a method that I imagine to be less familiar to the general medical world than its unquestioned merits entitle it to be.

A primipara of twenty-six was normally delivered of a girl during the night of the fourth of April, and until the evening of the eighth her condition remained satisfactory, without rise of temperature; but during that night repeated rigors occurred, and on the following morning her temperature ( $39^{\circ}\text{C.}$ ), pulse (120) and the odor of the lochia, showed undoubted uterine infection.

During three days the treatment was purely local; irrigations, scraping and curetting of the uterus; but by the thirteenth the continuation of the pyrexia ( $40^{\circ}\text{C.}$ ), and manifest enlargement of the spleen, made it certain that there was a general infective condition, although the absence of abdominal meteorism, of pelvic pain, and of vomiting, as well as a normally retracted uterus, showed that there was no trace of peritonitis.

Electrargol and collargol were freely administered up to the sixteenth, without improvement. At that stage we resorted to Marmoreck's serum, which was given in large doses, and which twice led us to hope, on account of a decrease in symptoms, that recovery was approaching.

On April thirtieth, in spite of the use of 530 c.c. of this serum, the patient's state was alarming; the temperature was high, the

pulse quick and thin, the spleen large, the right lung congested, and the urine scanty and albuminous. Besides, intolerance for the serum had manifested itself, in spite of the administration of calcium chloride: the patient's face was puffed up, the skin covered with patches of urticaria, and there were pains in all the joints. Obligated, then, to give up the use of the serum, I prescribed sodium nucleinate on May second; but this remedy, in doses of fifteen centigrammes, gave no result.

On May fourth the situation was critical, and the demoralization of both patient and her attendants complete. The woman complained of headache, and of respiratory anxiety; her face and extremities were swollen, there was constant, green vomiting, and scanty urine.

Remembering the improvement reported in such instances by Fochier's method of fixation abscesses, I decided on a last attempt, and on May fourth made an injection of turpentine. Two days after this injection, and coinciding exactly with the local reaction produced thereby, a remarkable remission occurred in the general symptoms; on the fifth day all fear had vanished, and on the tenth the patient was practically in a normal condition.

It is this striking success in a case of puerperal septicæmia, whose evolution was brought to an end by the artificial production of an aseptic abscess, that has led me to write about this therapeutic method which we owe to Fochier, a method usually termed fixation abscess, abscess of derivation, purifying abscess, abscess of neutralization or of immunization. These terms were destined by the writers who have used them to show at once the purpose of the injection; they gave, furthermore, a scientific stamp to a method that was in reality empirical. It is unfortunate, however, that experimentation has not confirmed a single one of these opinions; for this reason the name *artificial abscess*, which Bouvier has applied to the process, is, in my judgment, to be preferred to all of the others, because it does not pretend to explain the way in which this artificial aseptic pyogenesis acts on the diseased system, and does not attempt to settle the still unsolved problem as to whether we are to consider the artificial abscess as a focus of attraction, the rendezvous of the noxious substances circulating, or as a focus of production, a point of departure, of favorable substances,

derived from the leucocytes or their nuclei, antitoxic and immunizing.

When Fochier first brought forward his method in 1891, it received rather adverse criticism. Some claimed that the abscess had no action whatever; that it was merely a witness, and not an agent, of the cure; that it simply revealed by its production, the fact that the patient still possessed sufficient vitality, or power of reaction, to overcome both the parasite and the pyogenic substances administered in injection; that the abscess did no harm, but that it was useless; that the physician merely brought forward a tempestuous remedy at the happy moment, just before the crisis, for which he then assumed the credit.

Others satisfied themselves by simply refusing to admit any originality whatever in the method: an abscess, an artificial morbid alteration, which brings to an end another spontaneous morbid process going through its evolution in another part of the system, is no more than a revulsive agent in disguise; it is a treatment as old as the art of medicine, and its ancestors were called the cantons, moxa and blister.

Others, finally, relying on experimentation,—which, we must admit, is not favorable to the fixation abscess, since infected animals so treated succumb more rapidly than the controls and show no hyperleucocytosis,—were more severe, and condemned the method without appeal, the verdict being couched in somewhat the following terms: artificial aseptic pyogenesis was no doubt a therapeutic attempt designed with the best intentions; but nowadays it deserves only oblivion, and should never be employed.

At that moment the cause of Fochier's method seemed to be definitely lost (1892). But since that time, and in spite of the above sentence, physicians now often have had recourse to the artificial abscess in cases of septicæmia, and have obtained results that speak in its favor; it was these that I had in mind when I found myself in that position of affairs in which a physician must still know of something more to try, although it may appear certain that nothing further will avail.

But even in the hands of the physician who has succeeded with it, who owes to it, to use Professor Arnozan's terms, the inward satisfaction to be derived from the possibility of failing, convinced

that he has helped to snatch from death a desperately ill patient,—artificial pyogenesis will never be more than an exceptional method, a treatment to be kept in reserve for extremely serious, not to say desperate, cases. Artificial aseptic pyogenesis will never enter into current use, because the injection is very painful, and because it necessitates during its whole duration absolute asepsis. Failure to comply with this precept exposes the patient, through septic transformation of the abscess-focus, to desiccation of tissues, gangrene of the skin, aponeuroses and muscle-sheaths, suppuration of the neighboring joints, and to interminable pus-formation. To this must also be added the reluctance felt to produce painful and abundant suppuration in a patient exhausted by infection, and demoralized, as well as those about her, by the failure of the therapeutic efforts that have gone before.

In order to convince you of the quite exceptional circumstances in which this method, which is not without its drawbacks (of which the patient's relatives should always be made cognizant in advance), has always been employed, it will suffice for one to lay before you the remarks made by the physicians who have published their cases, after having resorted to aseptic artificial pyogenesis. One man describes the state of his patient as the gravest imaginable, justifying the most hazardous therapeutic efforts; another speaks of a very alarming, almost desperate condition, death seeming inevitable; in other cases the patient has been considered as good as dead, and the physician, though feeling it his duty to try the injection of turpentine, has had no hope of being called on to open the abscess to which it would give rise.

In making these quotations it has not been my idea to lead you to think that the artificial abscess is capable of raising the dead, of realizing what cannot be realized, of bringing back to the normal a body whose reactive power is exhausted. As Professor Chauffard has well put it, a therapeutic effort can only appeal to a reaction, to an effort of a healthy state against a diseased one; where a relative state of health has ceased to exist, no therapeutic action is any longer possible. This is also true for the artificial abscess, which cannot bring its effect to bear, unless the diseased body is still in a condition to reply to the turpentine's summons to suppurate.



It is therefore advisable to permit to pass away, without inflicting further sufferings, elderly patients worn out by years, undermined by multiple visceral defects, overcome by disease, and fallen to the lowest degree of collapse; and to reserve this exceptional treatment of the creation of an artificial abscess, when all other treatments have failed, for patients not too old and who still have some power of resistance,—such as the following, for instance.

A physician is called on to treat a serious case of toxi-infection, acute or subacute septicæmia without localized visceral suppuration, due to the streptococcus, staphylococcus or pneumococcus. The point of origin of the infection, skin, respiratory, digestive or uterine mucous membrane, occurring during an attack of influenza, small-pox, scarlatina, pneumonia, enteritis or puerperal infection,—is of only moderate importance; the chief consideration is that there should be a *generalized* microbial invasion.

His duty is first to apply a specific remedy, antistreptococcic serum, or hypodermic preparations of yeast. If he has no such antimicrobial agent, or if such an agent has no effect, which is common, he should next fall back on the colloidal metals, which act like ferments, and he should prescribe intravenous injections of collargol, or hypodermic injections of small-grained, electrolytic silver, gold or palladium. Intra-venous collargol, as advised by Professor Netter, has seemed to me the most efficacious; sodium nucleinate, applied within the uterus (gauze soaked in a 5 per cent. solution), and in hypodermic injections (0.05 every six hours), generally brings on a salutary reaction. At the same time he can moderate the hyperpyrexia (as a patient cannot without risk remain steadily at a temperature of over 40°) by cold baths, and thereby influence, as well, the principal functional derangements of the nervous system (delirium, tachycardia), of the heart (inadequacy), and of the kidneys (impermeability).

If all of this treatment proves without result, and if in spite of all his efforts he sees the patient's means of defence steadily failing, it is then that by a final effort he must endeavor to win a costly victory over the parasite by creating an artificial abscess,—costly, as the remedy is painful, and not without drawbacks.

The origin of this method is an interesting one.

Aseptic artificial pyogenesis, as a therapeutic means, arose from the observation that the termination of an infectious disease was often announced by an abscess, called a critical abscess. Chomel noticed that the external occurrence of an abscess during the course of a disease was far from being an event so unfavorable as might be thought, and even frequently followed by sudden and final improvement. Servieux, again, remarked that in certain instances the development of acute, peri-uterine inflammation seemed to draw the attention of the system to that region, and to silence, for a while, or permanently, an alarming peritoneal condition.

In 1891, Fochier expressed the same idea: "There are cases of puerperal fever, exceptional although not positively rare, in which a generalized infection, without any appreciable important lesion, is suddenly observed to improve at the same time that a local suppurative process appears, a mammary abscess, for instance, an abscess of the iliac fossa or of the subcutaneous cellular tissue, a monoarthritis, or a salpingo-ovaritis. These local processes manifestly save the whole situation, whether they be treated surgically, or abandoned to a spontaneous evolution."

Credit must be given to Fochier for having evolved, from previous clinical observation and from his personal experiences, a therapeutic means of which the purpose is to imitate nature in one of its curative methods by giving rise to an artificial abscess.

How are we to accomplish this?

The artificial abscess must be produced in an aseptic manner, and must remain aseptic. To produce it we use spirits of turpentine, for, as Grawitz was the first to remark, turpentine is the most advantageous and quickest chemical substance for setting up aseptic pyogenesis. The turpentine must be pure, sterilized, fresh, or old and concentrated,—although in the latter form it may produce gangrene.

The injection should be made at a point where the abscess will be easy to treat, and where its results will be not too unpleasant, such as the sides, the regions of the deltoid or trochanter, the outer aspect of the thigh,—in short, at a point where there is plenty of subcutaneous tissue. It is useless to place the abscess directly over the lesion (thoracic wall, in the case of pneumonia, for instance), in order to obtain a more marked revulsive effect.

Before making the injection the chosen region should be thoroughly disinfected with soap, alcohol and ether. When this has been done the injection is made with a sterilized Pravaz syringe and short needle, one c.c. of spirits of turpentine being placed in the cellular tissue, avoiding the skin and the immediate neighborhood of the aponeuroses, in order not to give rise to tissue-necrosis. Care should be taken to incline the needle in the direction of the part toward which it is desired that the abscess should spread: toward the umbilicus, if the side has been selected, or toward the anterior aspect of the thighs; it is always well to be on one's guard against the proximity of large vessels or joints. The injection must never be intra-muscular, and must never be made in œdematous tissue, whatever may be the cause of the œdema; as in such tissues turpentine gives rise to disastrous suppuration and gangrene. As soon as the injection is made, the region should be covered with aseptic gauze.

One,—in some rare cases, two,—symmetric injections of one c.c. of turpentine, should be made on the first day; doses of three and four c.c. in one region may produce enormous abscesses, gangrene of cellular tissue, and such destruction of the parts as may be very serious for the patient and alarming for the physician. Such doses should never be used.

At the moment when it is made the usual injection is not more painful than an injection of morphine; but in a few hours the commencement of the reaction is heralded by pain and burning sensations. This pain may be sufficiently important for simple contact with the region to become unbearable and induce insomnia.

Before long there appear red streaks, or patches, ecchymoses, covering a diffuse, œdematous swelling that may include the greater portion of the region (arm, thigh, abdomen) selected for the injection.

This is the first phase, the phase of diffuse, œdematous inflammation, always very extensive, and lasting from 24–48 hours. The most interesting detail at this stage, from a practical standpoint, is to remember that the more lively the reaction the better the prognosis.

During the second, or local reaction, phase, the swelling becomes more limited, the pain disappears, and the disorder pro-

duced takes the form either of an ordinary, circumscribed abscess, of a more extensive process with occasional patches of gangrene, or of diffuse suppuration, though without the usual serious results of the latter process.

Experimentally, the two phases, cedematous diffusion, and localized suppuration, are very distinct, in the dog; but it should be known that a reaction is not an invariable phenomena. Considering then only the reactive period, the latter phase may either be entirely lacking, moderate, or violent.

When there is no reaction at all, the prognosis is grave; this indicates that the toxi-infectious disorder will have a fatal ending. The patient's system is no more capable of reaction against the chemical agent than against the germ poison.

When there is a moderate reaction, the abscess goes through its evolution in a quiet manner. In this event there should be no haste in opening it, particularly if all serious symptoms have disappeared; and even before opening it, if the disordered state continues, it is well to produce another abscess. The administration of sodium nucleinate stirs up such sluggish abscesses in the most remarkable fashion, as will be seen from the following case-report: Mrs. X., primipara of twenty-five, was normally confined on May 21st. Forty-eight hours later, streptococcic septicæmia, with an intermittent type of pyrexia, set in ( $40^{\circ}$ – $41^{\circ}$ C. in the afternoon,  $37^{\circ}$ – $38^{\circ}$ C. in the morning), with frequent rigors during the day. On the 27th, the uterus was drained with iodized-iodine dressings. On the 30th, an artificial abscess was created, which only produced a moderate degree of reaction. On June 5th, midnight, the 17th day of the disorder, some gauze soaked in a 5 per cent. solution of sodium nucleinate was placed in the uterus, and a hypodermic injection of 0.05 prescribed every six hours. On June 6th, 8 A.M., the temperature was 38.2, and at noon, 36.9. The patient's condition was completely transformed and every sign of septicæmia had disappeared. The lifeless, artificial abscess became active on the 6th, and reached its full development on the 10th, when it was opened.

A hopeful reaction, with beneficent suppuration, should be a rapid, violent one. Such a reaction should never make the physician uneasy, for the more rapid and abundant the formation

of pus, the greater the presumable resisting power of the patient, and the more favorable the prognosis. By the third day the pus is collected and becomes encysted; and it has but little tendency to break through, save at the points of gangrene. Spontaneous opening occurs from the 6th to the 15th day.

Fochier considered that such abscesses ought not to be opened; but this line of conduct is rarely followed. As soon as fluctuation is manifest, especially if the patient is fully convalescent, the abscess should be incised in order to prevent the development of an enormous pocket of pus spreading up between all the surrounding layers of muscles. Incision should be free, and aseptic, with or without local anæsthesia with ethyl-chloride.

Consequently, the most important points to be remembered in this discussion are that not over 2 c.c. of turpentine should be injected; that the abscess should not be opened too prematurely, particularly before fluctuation is manifest; and that the incision should not be made before unquestionable remission in symptoms has been observed.

The incision is usually made between the fourth and ninth days; it should always, as has been remarked, coincide with complete improvement in all the symptoms. The abscess should be drained, or not, as may seem best. The incision sets free pus that is creamy, fluid or granular, sometimes thick, caseous, like putty, holding in suspension gangrenous fragments of cellular tissue. Its color is either light yellow, greenish-yellow, blackish, or bloody. It either has no odor at all, or smells slightly of turpentine. In amount it varies, the quantity ranging between 50 and 400 grammes. Cicatrization takes place from the 10th to the 25th day, though it may in some instances require a month and a half, or more.

When, after opening the first abscess, the patient's general condition is not considered sufficiently satisfactory, another injection of one c.c. of turpentine should be made in a different region.

The results of the artificial abscess are as follows: Immediately after the injection there may be a temporary rise of temperature; but as soon as a good reaction sets in, the temperature descends, the pulse becomes less rapid, and the kidneys act more freely. When there has been albuminuria, it decreases. This improvement may be noted twelve hours after the injection, but

the temperature does not become quite normal until full suppuration sets in.

The therapeutic method of aseptic artificial pyogenesis may then be summed up in the following terms:

(1) An artificial abscess appears to have unquestionable therapeutic effects in cases of infection in man.

(2) An artificial abscess is indicated in all cases of ordinary, simple septicæmia, where other means of treatment have failed.

(3) The injection of 1 c.c. of sterilized spirits of turpentine into the cellular tissue, away from the dermis and aponeuroses, suffices to produce such an abscess. The intensity of the local reaction which it produces is in direct proportion to the patient's power of resistance.

(4) The opening of such an abscess should be neither premature, nor tardy, and should coincide with free, local suppuration, and with improvement in the serious general symptoms.

(5) An artificial abscess, from the moment of the injection of the aseptic pyogenous substance until the lesion is healed, should be treated on aseptic lines.

These conclusions sum up the regular, practical portion of aseptic, therapeutic pyogenesis; let me now proceed to the question of pathogenesis, the more disputed and less certain part of this subject.

As was observed in the early part of this article, the artificial abscess method is an empirical one that originated in an unquestionable fact,—the improvement occurring in some instances of septicæmia on the appearance of localized suppuration. But neither clinical experience nor experimentation have ever been able to demonstrate the mechanism of this relation, nor to explain the connection between the occurrence and evolution of an artificial abscess and the improvement in the patient's general, serious condition.

Not but what a great number of explanations on a pathological basis have been advanced; but no one of them can be proved, and they are all more or less pure theory. That this is a fact can be seen from the following.

Some writers claim that the artificial abscess has all the characters of an ordinary revulsive, since its action answers to the

very definition of remission, the cure of a spontaneous, morbid act in one portion of the system by the production of another morbid process in another part of the system.

Its action, like that of every revulsive agent is threefold, and due to the *pain*, which by reflex action stimulates the nervous system; to the distal, local *pain*, which relieves deeper, visceral pain; and finally to the *exudation* which attracts and eliminates toxins.

Other writers hold that it is rather the predominance of one of the elements of the revulsive process that is the important feature.

Fochier thinks that the abscess is a means of attraction, affixation, for the microbes and their toxins.

Revilliod is of the same opinion. He claims that the artificial abscess is a cleansing filter that collects and passes to the exterior the filth in the interior.

Professor Dieulafoy, partisan of the Hippocratic idea of metastasis, considers the artificial abscess as a point of attraction, collecting the myriads of leucocytes that would have been harmful to the viscera.

Trifon, in his thesis, adopts the theory of Toxin-fixation, but modifies this view, in that the abscess becomes a neutralizing centre, where the toxins are annihilated before they are ejected by the incision of the abscess.

Finally, Mercandino and Pinna, considering as of capital importance the clinically observed fact that the disease goes on or grows worse if the abscess is opened too soon without another one being brought on (which fact may be used to defend all the other theories), consider the artificial abscess to be not a toxic-infectious point of concentration, but a laboratory where are manufactured bactericidal, antitoxic, immunizing substances, which are taken up by the lymphatic current.

No one of these writers brings any clinical argument of a nature to carry conviction in favor of his way of interpreting the question.

Let us now see whether experimentation gives any scientific support to the method of artificial pyogenesis.

(1) The spirits of turpentine injected has no general, stimulating, ozono-antiseptic influence. Its action is limited to the

formation of an abscess, like any other pyogenic or chemical substance. It can therefore be inferred that aseptic artificial pyogenesis plays a part by itself, and is not dependent upon the chemical substance whereby it is produced.

(2) This aseptic pyogenesis has no need, in order to develop, of any specially infected or intoxicated ground, or of previous hæmatic modifications (hyperleucocytosis, or the presence of a large number of damaged red or white globules), since the artificial abscess occurs with *healthy* dogs in exactly the same way as it does with infected human beings.

(3) The pus of these artificial abscesses (whether in an ill man or a healthy dog) is always found to be sterile during infectious processes, whether these infections arise spontaneously, or are produced by specific bacteria.

(4) The pus of this artificial, chemical abscess in human beings, injected in animals, is not more toxic than pus coming from microbial suppuration. The abscess is therefore not an accumulation of specific toxins.

(5) The artificial abscess does not induce hyperleucocytosis in the blood; its action is therefore independent of phagocytosis.

(6) In the case of animals infected with the pneumococcus, streptococcus or staphylococcus, and in whom an abscess is induced by means of spirits of turpentine, death occurs more rapidly than with other animals. Fochier, it is true, claims, on the contrary, to have cured animals infected with the anthrax bacillus, a microörganism that produces but little toxin, and that cannot be found centered in the abscess. Up to this point nothing shows the nature of the part played by the abscess; but the following experiments might warrant an attempt to formulate a theory of pathogenesis.

(7) With rabbits (animals that react badly, or not at all, to turpentine) poisoned by arsenic, copper or mercury, Carle has found in the pus of the artificial abscess more toxic substances than in the remaining viscera. In view of the elective affinity of the leucocytes for toxic substances introduced into the circulation, this passive accumulation of toxins due to the quantity of poison-bearing leucocytes attracted by the turpentine, becomes a very constant phenomenon. The volume of the abscess in a healthy dog is the



same as in an intoxicated one; but the poison gives the abscess a specific character.

(8) Mercandino and Pinna, having injected the pus of a human artificial abscess into infected animals, found that the control-animals lived longer, though they did not recover. These writers therefore infer that useful substances are evolved and absorbed. No one of these results, however, explains the action of the artificial abscess, and I can find no difference between the abscess brought on in the case of a healthy dog and that of a diseased man.

It has seemed desirable to be somewhat complete, and to supply the empirical data and scientific documents, concerning this interesting therapeutic method; for physicians are required not only to be familiar with the different means of healing, but to be constantly on the look-out for ways of interpreting the method of action of the remedies they use.

## THE CARE OF THE NEWBORN\*

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GENTLEMEN:—I wish to speak this morning on a very practical subject, one which I am sure will be of interest to all of you, *viz.*: the care of the newborn.

Unfortunately doctors as a rule leave the care of the newborn infant entirely to the nurse without giving any specific directions as to its care. Even if the child is not premature, if it is a full term child, it is quite essential that the temperature be kept up by protection from cold with proper coverings and with the application of artificial heat if necessary. While this is true of the newborn infant at full term, it is particularly true of the prematurely born. When you consider that the child has come from a region in which the temperature is 98°F. and over, into a room where the temperature is rarely 80° F., you can see that the child may sustain a chilling through its surface immediately after birth, and the necessity of keeping it warm, maintaining about the temperature to which it has been accustomed, if necessary by artificial heat. If the child be premature this is particularly important, and to this end several varieties of incubators have been devised that the required degree of temperature may be maintained.

One of nature's methods of stimulating the centers of respiration is through the medium of the skin. Perhaps the principal thing which causes the child to make the first inspiration is the shock that is received immediately after the child is born coming from the warm temperature to which it has been accustomed. When you consider there is sometimes as much as 20° to 30° difference between the temperature of the room in which the child is born and that of the mother's womb, you can readily understand how much stimulation there is to the centers of respiration through the

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\* Clinical Lecture delivered at the University of Louisville Medical Department

skin. This known fact has been utilized as one of the methods of artificial respiration, rather one of the means employed to induce respiration in the newborn, *i.e.*, by immersing the child in hot water, then exposing it to the colder air, in order that it may be induced to breathe by the effect of this alternate heat and cold upon the skin. Another method is rubbing ice up and down the spine, or allowing cold water to trickle over the chest, this by reflex action causing the first deep inspiration. Therefore let it be remembered that maintenance of body temperature is the first and perhaps the most important feature to be considered in the care of the newborn.

Another important thing which is not often thought about is allowing the cord to cease pulsating, about eight inches from the abdominal wall, before the funis is ligated. Now, as it is true of maintaining the temperature in the premature child, it is more important in the premature to allow this phenomenon to occur than it is in the full term child. The reason for this is that a large amount of blood, sometimes as much as two ounces, remains within the vessels of the placenta and in the cord which could be utilized by the child if it were allowed to get into the vessels by means of the natural channel; in other words, if we tie the cord immediately after the child is born we shut off in the placenta and the cord about two ounces of blood which could be utilized in the circulation of the child if we allowed the cord to cease pulsating before ligating it.

Another feature of importance in this connection is to use material in tying the cord which will exercise the proper degree of pressure on the vessels in order to prevent hæmorrhage from these vessels. I have seen one premature child perish as a result of slipping of the ligature. I have seen another almost exsanguinated by the ligature which was put on the cord cutting through and severing one of the vessels. When we have a very fat cord, *i.e.*, one in which there is a large accumulation of Wharton's jelly, close to the abdominal wall, if we tie that cord with a silk ligature it cuts through the Wharton's jelly and does not make the proper amount of pressure on the vessels. The best material that can be used for tying the cord is a rubber ligature, one which will exercise continuous pressure; a rubber elastic ring which is cut from

a rubber tube of proper calibre, and placed over the cord by means of one of the devices that are on the market, is unquestionably the best method of tying the cord. As the Wharton's jelly atrophies, pressure is made continuously on the vessels and there is no possibility of hæmorrhage occurring.

When hæmorrhage occurs in the newborn it is very frequently from the umbilical cord because of faulty ligation, slipping of the ligature, severing of the vessels from too great pressure by a small ligature, etc. However, it may be said that the newborn baby is very prone to develop hæmorrhages from many organs of the body. I have seen hæmorrhage occurring in the supra-renal capsule, that is to say there was a large hæmatoma attached to the right kidney up under the inner surface of the liver. This child died with symptoms of intense jaundice, and autopsy revealed this hæmorrhage into the supra-renal capsule. I have had under my observation in the last month a child in which there was bleeding from the stomach, and a number of hæmorrhages occurred from the bowel. You know how frequent it is that we have "birth paralysis" of the child due entirely to extravasation or rupture of a blood vessel in the brain. Therefore it may be said there is a very great proneness to the development of hæmorrhages in the newborn. This is due to some inherent quality of the blood vessels of the child which allows the vessels to leak; to changes in the circulation incident to birth, or perhaps to septic infection causing both blood and vessel changes.

I may be permitted to mention a little more in detail the case in which hæmorrhage occurred from the stomach and intestine in a newborn child: On the third day after birth the child vomited pure blood. This was followed by vomiting during the next twenty-four hours of a curdled, or partially digested blood. The same day the child had two or three stools of typical meconium with which were several large clots perhaps the size and length of a thumb. In the next three days the child averaged six stools in the twenty-four hours each of them containing a large quantity of blood. In these three days, in other words at the end of the first week after birth, the child had lost one and a half pounds in weight.

The treatment in this case was that recommended by some of

the English authors,—the injection under the skin of a two per cent. solution of gelatine. To prevent the possibility of there being present any bacteria the precaution was taken to sterilize the gelatine solution twice. Of course in order to get the proper solution of two per cent., the gelatine has to be submitted to heat, and it is then allowed to cool. The so-called double sterilization is accomplished by bringing the gelatine to a boil and allowing it to cool; then again bringing it to a boil and again allowing it to cool before it is used. This was done in order to rid the gelatine of any tetanus bacilli which might possibly be present, as it has been frequently shown by examination that the ordinary commercial gelatine on the market contains the bacilli of tetanus. Therefore, if you ever pursue this method of treatment you should always obtain if possible what is known as the English gelatine, which is the purest article on the market, then as an additional precaution it should be doubly sterilized after the manner I have described.

In the case referred to the quantity given was ten c.c. injected under the skin three times in the twenty-four hours, each injection being the full quantity of ten c.c. The site of the injection was in the cellular tissue on the back of the child. In spite of the precautions taken, however, in the way of sterilization, four small abscesses resulted. But the ultimate outcome was complete recovery of the child, cessation of hæmorrhage from the stomach after the second injection, the disappearance of blood in the stools shortly thereafter, so that by the end of the seventh day the stools were entirely of meconium. On the ninth day some breast milk was allowed to be taken, and the stools assumed the normal yellow color. There were no further hæmorrhages.

As already indicated four small abscesses resulted on the back of the child at the site of four of the injections, necessitating opening and the evacuation of a small quantity of pus from each. With the small amount of pus which escaped from each incision there came a small bubble of air. Whether or not there was present the gas bacillus I am unable to state; of course the explanation may be that a small quantity of air was injected with the gelatine solution. I am inclined to think there was a slight disturbance from the gas bacillus, though no effort was made to determine the presence of this bacillus by bacteriological examination. This is

the second case of *melæna* that I have seen. The other one died. This child has entirely recovered, and at the end of the second week has regained its birth weight, in other words it has gained one and a half pounds since it began to take breast milk again.

Holt gives a series of cases collected from the literature, under the classification of *melæna*, an extravasation of blood into the intestine. He claims that no two observers have ever had as many as one-third of their cases recover, two-thirds of the cases proving fatal. I refer to this case in detail as an evidence that hæmorrhage in the newborn not infrequently occurs. I have rarely seen a child which started out more favorably. It was a plump, fat baby at birth, and weighed ten and a quarter pounds. On the third day I was hurriedly recalled, the message being that hæmorrhage from the stomach and intestine had occurred without any apparent warning.

One of the first things that must be done with the newborn baby after tying the cord is to see that both the nose and mouth are cleansed in order to prevent the aspiration of mucus into the lungs. This happens not infrequently. The first deep inspiration, especially when there has been a large amount of mucus within the vagina at the time the child was born, may carry down into the bronchial tubes a plug of mucus which will close one end of the bronchial tubes; closure of the bronchial tubes and failure of dilatation of that portion of the lung supplied by the occluded bronchus will result in a condition which we call *atelectasis*. *Atelectasis* is failure of a portion of the lung, it may be an entire lobe, to dilate or expand owing to some obstruction to inspiration. In such instances there is eventually a sinking in of the chest on that side because the lung does not expand, which often results in serious difficulty if the child survive. If the child reaches the age of puberty it is very apt to develop pulmonary difficulties, especially tuberculosis, in that portion of the lung which is not dilated. Therefore as a preventive measure, one of the first things to be done to the child is to wipe out the mouth and nose.

Most babies at birth are entirely covered with the *vernix caseosa* which prevents maceration of the child while it is within the uterus, and acts as a lubricant to the child as it passes through the genital tract. Some nurses make the mistake of attempting

to remove this from the baby without disintegrating it, that is without the addition of some oily substance. In the country at least the substance used for the purpose is usually lard. This sometimes results in irritation to the skin when considerable salt has been used in the lard for its preservation. Salt is an irritant to the skin of the newborn. In my own experience I have found olive oil best for this purpose. The child should be thoroughly anointed with olive oil and allowed to remain in a blanket clothed only in napkin, binder and shirt for several hours before any attempt is made to cleanse it. Then it will be found that the vernix caseosa can be removed without any difficulty and the child's skin will be in a normal condition.

The baby should have a daily bath, and this bath should be upon the lap of the nurse; the child should not be immersed in water until after the cord comes off. The cord usually separates by means of the process known as dry gangrene. There should be no secretion about the base of the cord, nor should there be any odor. The average length of time which it takes the cord to separate is from four to seven days. I have seen the cord fail to separate until the end of eighteen days, and one case has been reported where it did not drop off until the twenty-sixth day. Such cases, however, are exceptional.

The question of dressing the cord is a most important one, because the site of insertion of the cord at the navel is the point where infection not infrequently takes place. In boy babies, where the napkin is apt to be wet frequently high up over the abdomen, there is more danger of infection than in girl babies. If the proper dressing for the cord is used infection is impossible, otherwise septic infection may occur and cause the death of the child. When it does occur there is rapid involvement of the peritoneum; the infection may extend through the peritoneum and enter the liver, and result in death of the child from septicæmia.

Several methods of dressing the cord have been advised. There are two methods in common use, one is known as the dry dressing, the other the moist dressing. In the dry dressing one of the hygroscopic powders are used, one which will aid in the absorption of Wharton's jelly, and also serve as an antiseptic to prevent infection of the cord through the navel. The best drying powder

of which I have knowledge is one composed of salicylic acid one part and boric acid two parts.

The dressing which I have found very efficacious and satisfactory, one which can easily be applied by the nurse if necessary, is a dressing originally advocated by Vanarsdale composed of balsam of peru and castor oil. This was first used for the purpose of dressing indolent ulcers, sometimes for wounds that were slow in healing, but, as suggested by Gallant, it is of great service for protection of the umbilical cord. The formula is thirty drops of balsam of peru to one ounce of castor oil. This makes an excellent dressing for the cord, and does not injure the child's skin as sometimes happens when the dry dressing is used.

A piece of gauze three inches square, or round, is cut part of the way through the middle; the cord is then drawn through the opening and the gauze pulled until it is straight, that is flat on the abdomen. The mixture of balsam of peru and castor oil is then poured over the hole, considerable of it around the cord, then a dry piece of gauze without being cut, several thicknesses, is placed over the split edges and brought up over the abdomen; then a binder is placed over all this in order to prevent the cord from being torn or pulled when the child is handled. This dressing need not be removed until the cord has separated unless some accident occurs. If it becomes too dry, by removing the outer covering of gauze until the cord is exposed through the slit, additional balsam and oil can be poured upon it if necessary. As a rule this will not be needed, and if the dressing is allowed to remain intact for six or seven days it will be found that the cord will come away with the dressing when removed. This form of dressing should leave a perfectly smooth dry surface with a slightly depressed navel. Sometimes there is a small tubercle left marking the insertion of one of the three, or perhaps all three, of the navel vessels, and there is occasionally a small amount of secretion which escapes into this corrugated depression of the navel. When this occurs it is best treated with nitrate of silver solution, perhaps ten grains to the ounce of water, applied with a little cotton on a probe or match, afterward dusting with boric acid or even plain talcum powder and placing over the navel a dry dressing of gauze.

The binder is worn only until the cord has separated, or until



the navel has completely healed. It used to be the custom for the binder to be worn quite tightly during the first several months of the child's life. This is a gross error. I have seen two cases of inguinal hernia which developed as a result of wearing a very tight abdominal binder in new born babies. This should never be permitted, a tight binder should never be worn, in fact the only thing for which an abdominal binder should be worn is protection of the abdominal organs. The binder which should be used is one made of knit material with a small strap over each shoulder and projecting ends which can be pinned to the napkin both back and front, this being worn underneath the shirt of the child. The binder should only be worn as a protection to the abdominal organs, it should be worn loose and in this way give protection without running the risk of having hernia develop from pressure. Remember if a very tight binder is worn there is always danger of the development of inguinal hernia in the newborn, from pressure.

During the first week of the baby's life it is very prone to develop an elevated temperature: The abnormal temperature has been noted in a large number of observations, especially in the Sloane Maternity Hospital, New York, and has been designated by Holt as "inanition fever." In the issue of the *Archives of Pediatrics* (New York) in which Dr. Holt's article was published, appeared a paper I read before the Kentucky State Medical Society describing the same phenomenon under the title of "starvation temperature." This phenomenon will not infrequently be observed if the baby's temperature is taken often during the first week of life. Unfortunately this is not often thought of by the nurse, unless she has been especially instructed, and the doctor does not have the time or does not go to the trouble to take the temperature himself. The temperature of the newborn baby ought to be taken in the rectum twice a day for the first week of life. If the temperature is found to be much over 100°F. then artificial feeding ought to be commenced at once. If the temperature does not go over 100°F., then the baby should not be artificially fed. This starvation temperature usually makes its appearance about the third or fourth day, and sometimes is as high as 104°F., perhaps lower, ranging between 101° and 103°F., for two or three

days until artificial food is given, or until the mother's milk makes its appearance. If the baby is fed artificially, without any other means being used to reduce the fever, the temperature will usually fall to normal. This has been observed so frequently that there can be no question that lack of food is the cause of the fever. Starvation fever, or inanition fever, then, is something which ought to be looked after in the newborn.

Other evidences of the so-called starvation fever are, the condition of the child after it has nursed,—it is restless, there is constant drawing up of the legs, crying, hot dry mouth, and hot dry skin. It must be remembered that the first secretion of the breast is colostrum, and this acts as a purgative, sweeping out the meconium. Colostrum is soon entirely withdrawn leaving the breasts empty until the advent of the milk. There is no question that this rise of temperature is common in the newborn as could be easily proven if the temperature were taken with sufficient frequency. If the child is restless, and the cause thereof cannot be found, it is more than likely due to this so-called starvation temperature. And here is where our knowledge of modified milk stands us in good stead. We must give such a child modified cow's milk until the breast milk makes its appearance. You should think in percentages, and should be able to give such a baby the percentage of modified milk which can be digested and assimilated. Do not place the baby on milk which contains more than 25/100 per cent. of proteid, for this will afford proper nourishment until the mother's milk makes its appearance.

The possibility of development of sprue or thrush in the newborn ought always to be borne in mind. I always tell the nurse that there are two things which if they develop indicate gross carelessness on part of the nurse or whoever has charge of the baby, the first is the occurrence of sprue or thrush, the other is the condition which we call intertrigo. Thrush develops first by showing small white deposits about the size of a pinhead on the buccal mucous membrane, either on the surface of the gums or on the cheeks between the gums. These spread to the cheeks, then to the roof of the mouth, back to the soft palate, and if the disease is not checked it extends downward into the œsophagus and stomach.

Several cases of thrush have been reported where death resulted from inanition due to an inflammatory condition of the œsophagus and stomach from deposition and absorption of septic material. Thrush or sprue is due to the presence of the vegetable organism *oidium albicans* or the *saccharomyces albicans* in the mouth, probably from infected milk, or milk in which this organism has grown after it has gotten into the mouth. The remedy for prevention and for cure is a saturated solution of boric acid applied gently to the mucous membrane of the mouth. You can prevent and also absolutely cure thrush by washing or cleansing the child's mouth with boric acid solution. This is a very important measure and one which is often neglected. The child's mouth should be thoroughly cleansed both before and after nursing; before nursing as a protection to the mother; afterward for its own protection. By washing the mouth before the child nurses, if there exists a lesion of the breast or nipple, such as fissure for instance, infection through the medium of this fissure is prevented. By cleansing the mouth of the child after nursing we are assured that the mouth is aseptic and thus prevent trouble with the child. At the first evidence of development of a white tongue or white deposit on the child's gums, the nurse should be instructed to report the matter at once to the physician in order that he may promptly institute curative measures.

The other condition which I mentioned as being an evidence of carelessness on the part of the nurse,—intertrigo,—is the development of an eczematous condition about the buttocks of the child. The newborn baby may have and probably does during the first twenty-four hours quite a number of movements from the bowel; these, as you know, are composed of meconium. If this is allowed to remain in contact with the child's delicate skin for any length of time it is very irritating; therefore it should be removed immediately after it has been passed. The child may have six to eight movements from the bowel in the first twenty-four hours, and these frequent actions continue, diminishing slightly perhaps in quantity, for the first four or five days. The meconium should be removed from the skin by means of a soft cloth and water without the use of soap. Then the child's skin should be carefully dried and dusted with non-irritating powder such as talcum. If

this process of cleansing after defecation is carefully performed, intertrigo will never develop.

Another condition frequently arising through ignorance of the attendant is the eczema caused by the use of a napkin on the baby when it has been soiled by the passage of urine without the discharge of fæcal matter. I had under my care, not long ago, a case of eczema from this cause involving the whole fundament of the child which was covered by the napkin in a perfectly straight line around the abdomen enveloping the buttocks and the legs as far as the napkin extended. The attendant was in the habit of using a napkin without washing until a strong odor of urine was apparent. The child's napkins were dried before the fire, then used over and over again until there was an odor of urine present, when they were boiled and washed! The exercise of cleanliness, proper care of the napkins, and the application of a mild resorcin ointment finally resulted in an entire cure. Remember, then, that there may result a severe irritation of the skin of the child simply from ignorance, in the use of soiled napkins, not with fæcal matter but urine, and proper instructions should always be given in this particular.

Regularity in nursing the newborn child is a matter of great importance: This should be started after the third day when the advent of milk in the mother's breasts may be certain, and continued throughout the first three months. Thereafter nursing should not be quite so frequent. During the first two or three days, or until milk makes its appearance in the breasts, the child tugging and pulling at the nipple often increases the danger of fissure developing; whereas if the child is not permitted to nurse so frequently after the breasts are first emptied of the colostrum, the breasts are allowed a chance to recover from the pulling they have received. Then as soon as milk makes its appearance the baby should be put to the breast every two hours, at regular intervals, during the day while awake, but it should not be awakened for the purpose of making it nurse. During the night the intervals between nursing should be increased to four hours.

The establishment of regular feeding intervals, as suggested, has advantages to both the mother and the child; the baby becomes accustomed to the habit of nursing at regular intervals, and a

good flow of milk will be insured from the breasts. Usually the contents of one breast will suffice for a single feeding, but sometimes this is found insufficient and both breasts may be used. Ordinarily fifteen to twenty minutes will be required for each nursing.

Your attention is particularly called to another feature in regard to nursing which has not been sufficiently emphasized, *i.e.*, the practice so common with average mothers of inducing infants to take the breast all times of the day and night when they become restless or fretful. While it may be true, under these circumstances, that the child becomes quiet when placed to the breast, still the practice cannot be too strongly condemned, the reasons for which are obvious.

The child should not be permitted to sleep with the mother under any circumstances, because often the baby will nurse without the mother being conscious of the fact. So important is this feature that a separate bed should always be provided for the baby. This of course is done in all hospitals; but in the ordinary household a separate bed is not always obtainable, and it is necessary to use something else. The same results can be secured with an article which can usually be found in every household, *viz.*: a large wicker clothes basket. The bottom of this basket should be covered with a pillow and the child placed therein alongside of the mother's bed. This is a matter which is frequently overlooked or ignored, and many children have been smothered by sleeping in bed with the mother. This feature is regarded as so important in France that a national law has been enacted which has for its object preventing a child sleeping in bed with its mother. Numerous instances have been recorded where infants have been smothered by the mothers unconsciously overlying them during sleep. Always remember this and instruct that the child shall not be permitted to sleep with its mother under any circumstances.

One thing which I am particularly anxious to impress upon you in connection with the care of the newborn is the importance of using the Credé method of preventing ophthalmia neonatorum. While it may be true that ophthalmia neonatorum is less common in the country than in the centers of civilization, yet we must

remember that the disease which causes it is not unknown even in remote districts. When I relate to you one unfortunate experience of my own, in which the Credé method was not employed and the child developed ophthalmia neonatorum in both eyes, and as a result lost the sight of both eyes, one through perforation of the eyeball and extrusion of the contents, the other because of prolonged suppuration, I believe you will fully agree with me as to the importance of preventive measures.

As you are probably aware, the Credé treatment consists in the instillation of a drop of a two per cent. solution of silver nitrate into each conjunctival sac immediately after birth of the child, this being neutralized by the use of normal saline solution shortly afterward. I have used this method for a number of years, both in hospital and private practice, no matter whether there be present any possibility of infection or not so far as I am able to ascertain, and the only case of ophthalmia neonatorum which has occurred in my entire experience was one in which unfortunately this precaution was not observed.

As you know ophthalmia neonatorum is a disease caused by entrance into the conjunctival sac of gonococci during the passage of the child through the maternal birth tract. No matter what may be the social standing of the parturient woman, there is no case which will ever come up in your practice where you can positively declare that the cervical or vaginal secretion does not contain gonococci. In fact it has been demonstrated that this organism may be present in the vagina for an indefinite period without causing any symptoms, but of course this is not the rule. Therefore you will see the importance of using the Credé method of treating the eyes of the child in every case of labor, no matter what may be the circumstances or condition of the patient.

At the time the unfortunate case I have mentioned occurred, and it was in a charitable institution, it was my rule to use the nitrate of silver treatment. The bottle was gotten out of the case at the time of delivery, and by accident was overturned just before the baby was born; there was not a drop of the solution left in the bottle. As so often occurs, this baby was born in the early hours of the morning. The bottle in which the supply of silver nitrate solution was kept was not sent to the druggist at once

because of the early hour. Not having a trained nurse, and not believing it advisable to permit any of those present to make the application, I decided to wait until my next visit. I was called away and did not get back to the case until the following morning. By that time the damage had resulted, the child had developed an extensive ophthalmia, with the outcome as I have already indicated. Of course looking back upon the case now my duty was clear, I should have waited until silver nitrate solution could have been obtained from the druggist and made the application immediately after delivery. This was a most serious mistake on my part, and one which I shall never cease to regret.

Doubtless you have all heard objections raised to the application of silver nitrate to the eyes of the newborn, that there always occurs an irritation of the conjunctivæ, etc. It has never been denied or disputed that some conjunctival irritation occurs, but it is not extensive and there is never a great amount of pus. Moreover, I have found that immediately after instilling one drop of the silver solution into the eye, if a small amount of normal saline solution is squeezed into the eye from a pledget of gauze, that irritation from the nitrate of silver is prevented without in any way lessening its effect.

When you take into account the number of patients that are in the blind schools throughout the country, and learn how many of these patients became blind from ophthalmia neonatorum, I think you will be fully impressed with the importance of using preventive measures. In some cities there is an ordinance which requires that all cases of ophthalmia neonatorum be reported to the health authorities, and there are some states having laws to similar effect; but regardless of these legal enactments such cases are seldom reported. In many instances the accoucheur is an ignorant midwife who knows nothing about, nor does she believe in, ophthalmia neonatorum. Of course the object of the law is to attempt to compel the attendant to report such cases when there is the least suspicion of infection, and not permit them to continue until it is too late for treatment to be of any avail, in order that blindness may if possible be prevented.

In the case which I have reported to you in detail, notwithstanding the most careful attention, with two trained nurses in

constant attendance, and with the services of competent specialists, complete blindness resulted.

Some of the best ophthalmologists have suggested the advisability of having a law such as I have mentioned placed upon the statute books of every state, making it punishable by fine and imprisonment if the physician or midwife who attends a case of labor fails to report all instances in which there is the least suspicion of infection of the child's eyes.

If we can prevent the development of ophthalmia neonatorum, as we can almost certainly do by the Credé method, we should always do so. If you do not wish to use nitrate of silver you can employ a solution of protargol which is slightly milder than silver nitrate and has been said to be effective; but at all events use some form of silver in the eyes of the newborn in order to prevent the development of this dread disease,—ophthalmia neonatorum. Nitrate of silver is certainly a preventive, and the cases in which it has caused any permanent injury to one or both eyes are very rare.

The practice of circumcising male infants when a few days old has prevailed since time immemorial and has had many earnest advocates, but I have never been able to understand the reason for perpetuation of such a relic of barbarity. In the majority of instances circumcision is not only unnecessary but absolutely uncalled for and has been known to result in deformity. Moreover, accidents have happened in the performance of this apparently simple operation, and the glans penis has been completely severed. Instead of sacrificing the foreskin by circumcision, it should be carefully retracted or reflected when the child is a month old, and after cleansing the glans penis, which has hitherto been covered by the adherent prepuce, and removal of the large accumulation of smegma by adequate washing and application of olive oil or vaseline, the foreskin should be replaced. This should be repeated two or three times a month by the nurse or mother during the first few months of life, then later at longer intervals. If these precautions are observed there will be no future accumulation of smegma, phimosis together with its concomitant nervous phenomena and the so-called pin-hole prepuce will be obviated, likewise the elongated and pendulous foreskin oftentimes observed in later life will be prevented.



## THE PERFECTED SURGICAL TREATMENT OF FIBROID TUMORS OF THE UTERUS

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It would be difficult to find within the entire scope of modern surgery a subject affording greater interest than the evolution and perfection of the surgical treatment of uterine fibroid tumors. Following immediately after ovarian tumors and ovariectomy, for a number of years the attention and labor of abdominal surgeons was concentrated upon this subject. An outline of the history of this surgical achievement will be substantially a résumé of the development of modern abdominal surgery.

Until two decades ago the treatment of uterine fibroid tumors was of little avail. Even after ovariectomy was perfected, the mortality following operations for uterine fibroids was so high as to contraindicate operative intervention. The early ovariectomists, the Atlees, Sir Spencer Wells, Clay, and Kimball, after reducing the mortality of ovariectomy to a degree that placed it within the scope of legitimate surgery, were unable to place the surgical treatment of uterine fibroids upon the same basis. Yet the pioneer work of these men in the treatment of uterine fibroids was of inestimable value in laying the foundation for the successful work of their followers. In those early days few had the temerity to attack these tumors in a surgical way, and all ordinary palliative measures were applied by the profession without success. Among these measures were the subcutaneous administration of ergot, and also the injection of ergot into the substance of the tumor. Later on, while the mortality after the operation was so high, under the leadership of Apostoli, of Paris, electricity was invoked in a vain effort to arrest the growth and reduce the size of these tumors. The results from all such treatment were disappointing, and hundreds of deaths annually occurred, to say

nothing of the suffering by pressure and hæmorrhage, from the progressive growth of these neoplasms.

In America the name of Gilman Kimball, of Lowell, Massachusetts, will always be associated with the operative treatment of fibroid uterine tumors. In Great Britain the name of Thomas Keith, of Edinburgh, will mark the greatest of the early achievements in this work. On the continent of Europe the work of Kœberlé, of Strassburg, contributed a full share to the early success which placed the operation upon a substantial basis. To these men of profound surgical knowledge and great skill the operation for extirpation of large fibroids was the subject of constant thought and unremitting toil. The subject was one which could not be put away; these tumors were so common and all non-surgical methods of treatment so ineffectual, while the suffering and mortality were so great, that it was persistently forced upon the attention of gynæcological surgeons in all countries.

The limits of this article forbid a thorough consideration of the pathology and morphology of uterine fibro-myomata. The interstitial variety of the tumor being the most common, and both the interstitial and subperitoneal so frequently existing in the same individual, nothing short of complete extirpation by abdominal hysteromyomectomy could be relied upon for radical cure. The feature of uterine fibroids which stood in the way of attaining the same results after hysterectomy as after ovariectomy was the different structure of the pedicle. In ovariectomy the double fold of peritoneum known as the broad ligament afforded an ideal pedicle for the ligature; the cervix uteri being the pedicle of uterine fibroids presented to the surgeon a muscular and therefore contractile structure to be secured. It was for this reason that throughout the development of the surgical treatment of uterine fibroids interest constantly centered about the treatment of the pedicle. When efforts were made to ligate the pedicle with heavy silk ligatures and to drop it into its place at the floor of the pelvis, retraction of the muscular fibres would free the ligature and death from hæmorrhage would often follow. Moreover, in the early work it seemed that sepsis more frequently followed this operation than ovariectomy. Under the leadership of Atlee, Keith, and Kœberlé, the uterine cervix forming the pedicle of the

tumor was secured by a clamp and brought into the lower angle of the abdominal incision and fixed there. While this method seems crude in these modern days, it should not be forgotten that the mortality was reduced to such a low degree under this method as to make it a popular and reasonably safe surgical procedure.

Such was the extent to which hysterectomy for uterine fibromata had advanced when the teachings of Lister brought a new era in surgery and did away with the greatest factor in the mortality, *viz.*: sepsis. Even after the modern technique had eliminated sepsis, the clamp or *serre-neude* of Kœberlé was used with splendid results by many leading surgeons. The brilliant work of Lawson Tait, in England, and Joseph Price, in America, was done with the *serre-neude*.

The technique of intra-peritoneal surgery steadily advanced and finally reached its present state of perfection; the treatment of the pedicle after hysteromyomectomy likewise was improved and perfected. The persistent efforts of Howard A. Kelly to do away with the *serre-neude* and fixation of the pedicle in the abdominal incision were of great value in bringing about the ultimate accomplishment of this purpose. He endeavored to suspend the pedicle by ligatures so that it would be inside the abdominal incision and practically outside the peritoneum. The greatest contribution to this achievement was made by Lewis A. Stimson, of New York. He demonstrated that by ligaturing the trunks of the ovarian and uterine arteries upon each side, hæmorrhage was absolutely controlled and the pedicle rendered practically bloodless. The introduction of absorbable animal sutures completed the work by enabling operators to secure the small vessels of the pedicle and cover the same with the peritoneum, thus rendering it within the deep pelvis but outside the peritoneal membrane.

During the years immediately following the introduction of Listerian methods the greatest activity prevailed in gynecological surgery. Naturally the treatment of uterine fibromyomata afforded a field most inviting to the ingenuity of surgical achievement. Many prominent and authoritative surgeons working in this field conceived and applied a variety of methods, and for a long time professional judgment was unsettled as to the best procedure of the many that were presented. Among these was the operation

for uterine fibro-myomata known as pan-hysterectomy, which consisted not only in removing the tumor in its entirety, but also removing the pedicle, which is the uterine cervix. By this operation the vagina of course was opened, and this canal was first used for drainage; later as drainage was found unessential, the vagina was closed with absorbable sutures after excision of the cervix.

Two important additions to modern surgical technique gave great impetus and added very materially to the facility of the operations under consideration: I refer to the Trendelenburg position, which affords unobstructed view and access to the floor of the pelvis; and the use of gauze for holding the intestines out of the field of operation and protecting the peritoneal surfaces during prolonged manipulation in the pelvis. With increased experience it became apparent that the operation of choice would be the operation which preserves the pedicle (*cervix uteri*) and closes the peritoneum over it by a running suture across the floor of the pelvis. This operation has the advantage of being accomplished in shorter time than the procedure known as panhysterectomy, and also protects the peritoneum from possible infection by opening the vagina.

The operation as now perfected is as follows: The abdomen is opened with a free incision; the tumor explored by the operator's hand and freed from adhesions; air is then admitted posterior to the tumor by lifting it up and the tumor then turned out through the abdominal incision; the patient is then put in the Trendelenburg position (if this has not already been done), and the intestines packed off toward the diaphragm by flat gauze pads. The next step in the operation is to secure the vascular broad ligaments and determine as to preservation of one or both ovaries, or a part of one ovary if not too extensively diseased, and the removal of the Fallopian tubes. Clamps are placed upon each broad ligament so that it may be divided between the clamps and thereby enable one to minimize the loss of blood; the peritoneum is then split across the anterior surface of the tumor just above the bladder, and the bladder pushed off from the anterior aspect of the uterus; this will protect the bladder from injury in the further steps of the operation and also provide an anterior flap for covering over the pedicle. The tumor is then turned forward toward the pubes

and a flap of peritoneum dissected off in a similar way from the posterior aspect of the tumor. The tumor will now be only attached by its pedicle, the cervix uteri, and the uterine arteries are on each side close beside the cervix; these are now secured by placing a ligature securely around them low down; the ovarian arteries are likewise secured on each side by ligatures and the clamps removed; the pedicle is then cut across leaving a cup-shaped cavity in the pedicle at this point, and the tumor laid aside. As this procedure advances flat gauze pads are placed beneath the tumor over the peritoneal surface so as to protect it from traumatism and concealed infection from accidental discharges from the cervical canal when the tumor is cut away. Many operators apply the actual cautery to the cervical canal in the pedicle to secure asepsis at this point, while others use chemical germicides, preferably pure carbolic acid, for this purpose; others take no especial precaution in this respect, and the results are equally good apparently after all methods, provided the important steps of the operation are done with equal skill and care.

The tumor being removed the operator turns his attention to suturing the pedicle across with chromic catgut so as to secure the small vessels which supply it from the vaginal arteries. This being done, the peritoneum is sutured with a running suture from the broad ligament on one side entirely across the floor of the pelvis to the corresponding point on the opposite side of the pelvis. The pedicle is then entirely covered by peritoneum, and the female pelvis has been converted into a condition corresponding to the male pelvis. The gauze pads are then removed, the vermiform appendix examined, and the abdomen closed, thus completing the operation.

In this procedure as above described no mention has been made of the numerous complications which may occur with fibroid uterine tumors. It is quite common to find pyosalpinx associated with these tumors, together with universal adhesions that result from long-standing inflammatory process within the pelvic peritoneum. It will be apparent that the operative procedure will be much more difficult under such circumstances than in simple tumors free from adhesions and purulent collections.

Another complication adding very much to the difficulties of

the operation is the locality in which the tumor has developed with relation to the broad ligaments. On account of the anatomical arrangement of the broad ligaments, these tumors often grow between the folds of these ligaments and are so situated beneath the peritoneum that they cannot be turned out of the abdomen until they have been extricated from their bed posterior to the peritoneal envelope. Such arrangement varies within broad scope and often presents complications of great difficulty. It is in such cases that the ureters may be enclosed partially or wholly within the tumor and necessitate most careful dissection for the intact preservation of these important structures. In other cases the tumor grows in such a way as to carry the bladder above the umbilicus, rendering it an easy accident to cut into the bladder unawares. Occasionally the tumor is associated with ovarian degeneration and ovarian cystomata so as to render the diagnosis difficult and the operative procedure puzzling. Fibroid tumors are subject to various forms of degeneration, and may undergo necrosis and inflammatory changes, thereby materially complicating the operative procedure.

Another complication of uterine fibro-miomata by no means uncommon is that of pregnancy. A woman may be the subject of a fibroid tumor so small in size and producing so little disturbance that its existence has never been recognized, and under the stimulus of pregnancy it takes on rapid growth and soon becomes conspicuous by its pressure and prominence. The most deliberate and careful judgment should be exercised in determining the treatment of these cases. When the tumor is located in the upper pelvic zone, so that it will rise high in the abdomen as the pregnancy advances, it will seldom be necessary to resort to its removal during pregnancy. Nature has wonderful resources in providing for these growths when moderate in size, and likewise has great facility in overcoming the obstacle they afford unless impinging directly and forcibly upon the parturient tract; but when necessary the surgeon need not hesitate to remove these growths during pregnancy with every confidence of satisfactory results. The writer has confirmed in his own experience the observations frequently made of removing uterine fibroids of considerable size during pregnancy without interrupting the course of utero-gestation. When, however, the

tumor is low down and occupies the lower pelvis so as to obstruct directly the outlet, it may be necessary to resort to the Porro-Cæsarian section at the end of utero-gestation, or may be to do an hysterectomy in the early months of pregnancy provided the tumor is of such large dimensions as to necessitate early operation.

With the perfected surgical treatment of uterine fibroid tumors as here described, there is little to be desired in the hands of experienced and skilled abdominal surgeons, as the mortality has been reduced almost to the vanishing point. Even in neglected cases, where the patients have been reduced by hæmorrhage and pressure to a deplorable condition of emaciation and anæmia, the operation is followed by brilliant results. When done in good time, before exhaustion, degeneration, and inflammatory changes have added to the difficulties of the procedure, the operation ranks along with ovariectomy among the most successful of all the major operations of modern surgery.

# Neurology

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## FRACTURE OF SPINE

BY G. L. WALTON, M.D.

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A man of 60 was brought to the accident room of the Massachusetts General Hospital six days after having fallen from a roof, striking upon his back. He had to be lifted up bodily. Since that time has had no use of his lower limbs. Physical examination showed bilateral, but not complete, loss of sensation to a line two inches below the nipple. For an inch or two above this line there was an area of hyperæsthesia, above which point sensation was normal. There was loss of all normal reflexes, planter, Achilles, patellar, cremasteric, abdominal and epigastric. The Babinski phenomenon was present and marked. There was no motion beyond a slight extension and flexion of the toes of the left foot. The patient required catheterization.

Examination of the back showed no bruise and no irregularity of vertebræ, but there was an exquisitely sensitive spot at the level of the fourth dorsal vertebra.

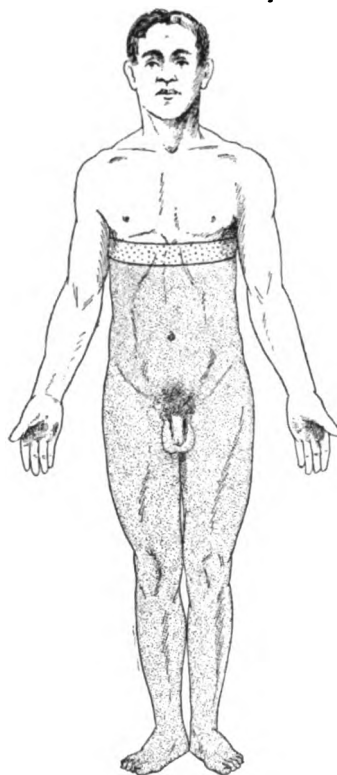
This combination of symptoms *establishes fracture of the spine with crush of the cord*. That the crush did not absolutely destroy continuity is shown by the presence of a certain degree of movement, and the presence of the Babinski phenomenon. Operation was advised, partly on account of this fact, and partly because of the hope that it might at least relieve the pain from the pressure of bony fragments. The patient entered the house in the service of Dr. M. H. Richardson. Within a short time, and before operation was undertaken, the breathing became shallow, the patient complained of intense epigastric pain, became collapsed, and died within a few hours.

At the autopsy, which was performed by Dr. McGrath, various surmises were offered as to the immediate cause of death. Among



these causes were suggested dilatation of the heart with thrombosis, retroperitoneal hæmorrhage, the bursting of an aneurism, hæmorrhage or other lesion of the brain. The autopsy revealed a large hæmorrhage in the left pleural cavity produced by fracture of a rib at the height of the vertebral lesion, rupturing a superior intercostal vein. The heart was greatly dilated.

FIG. 1.



Fracture of the fourth dorsal vertebra. Dotted area shows hyperæsthesia; darker portion shows anaesthesia.

The spinal injury was found, as predicted, to be a fracture of the fourth dorsal vertebra with crush of the cord. No fragment of bone was found pressing upon the cord; the cord itself was swollen, discolored, obviously disintegrated, but with no gross hæmorrhage in or about it. This is the common finding in such cases.

This case offers a number of points of practical interest. In

the first place, with regard to local injury, operation is often undertaken in the hope of removing fragments which are pressing upon the cord. This hope is, in the great majority of cases, futile. In cases of complete paralysis below the point of injury the cord has, it is true, been crushed, but experience shows that the bones which have caused the crush rarely remain in contact with the cord. Fragments of bone may, however, impinge upon the nerve roots, and removal of such source of pain justifies operation in these unfortunate cases, and further, in case there are still signs of life below the point of injury, it is always possible that there may be some constriction of the cord to be relieved by operation.

With regard to the immediate cause of death, the case emphasizes the fact that collapse, shallow breathing, rapid pulse and pallor denote serious hæmorrhage, whether into the abdominal, thoracic or cranial cavity. The seat of the hæmorrhage is generally indicated by the symptoms, among which pain is prominent. The pain in this case was epigastric and was the feature which led to the suggestion of hæmorrhage into the abdominal cavity. Pain may be referred to the epigastrium, however, from various regions. It is not an uncommon symptom in appendicitis, or may again result, as in this case, from thoracic lesion.

Another point of interest in this case is the reflex condition. There is still a tendency to cling to the old teaching that destruction of the upper part of the spinal cord produces exaggeration of reflexes through cutting off inhibitory influence from the brain. It is a fact that sclerosis and other chronic lesions of the upper spinal cord or of the brain produce exaggerated reflexes. Upon this fact has been based the conclusion that the human reflex mechanism is identical with that of the frog. In the frog the brain may be completely severed from the cord without lessening the activity of the reflexes, indeed the reflexes will be increased by removing the inhibitory influence. In man the case is quite different. Ample experience has shown that complete destruction of the upper cord produces, not only loss of power and sensation below the lesion, but loss of reflexes. This is an invariable rule and has been pointed out by more than one observer, but conservatism still leads the practitioner to regard each such case as an exception.

The explanation I would offer for this difference between the

reflex mechanism of man and that of the frog is that, whereas the reflex arc in the frog is practically limited to the cord, the reflex movements in man are the resultant of combined activity of various reflex arcs at different levels, from the lumbar region of the cord, to the cortex of the brain. The characteristic spinal reflex is a quick and exaggerated reflex; that of the cerebral arc a more subdued reflex. In health the resultant is a comparatively subdued reflex. In partial withdrawal of the cerebral influence, the spinal arc predominates and the result is an exaggerated reflex. But if the cerebral arc is entirely destroyed, or cut off, the spinal arc is not able in man, as it is in the frog, to produce alone a reflex. The result in this case is relaxed, not spastic, paralysis in the affected parts. The question is, however, still open as to whether the reflexes may persist after *very slow* destruction of the upper cord.

In the majority of cases of apoplexy with hemiplegia, the knee jerks will be found *diminished or lost* rather than exaggerated at the onset of the trouble, but as convalescence ensues, and the brain takes up its function to a greater or less degree, the reflexes return, to become, as a rule, exaggerated on account of the predominance of the spinal element.

In certain cases, presumably those in which the cessation of brain function is not complete, the reflexes are present and exaggerated from the first, but my experience in a long succession of cases would tend to show that these cases are altogether in the minority.

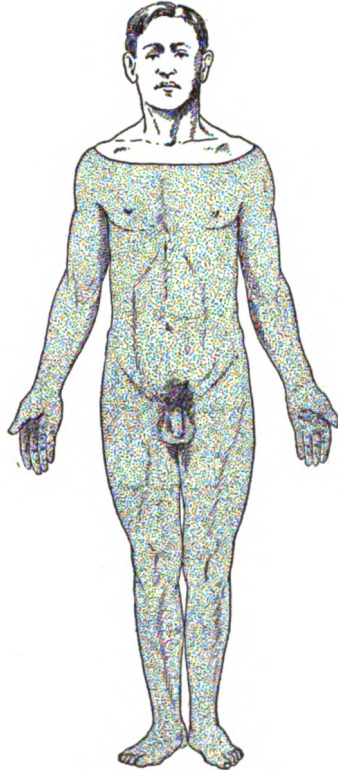
In some cases, as in that of the broken back above cited, all reflexes are absent excepting the Babinski reflex, and it has been suggested that the spinal cord alone is capable of producing this abnormal reflex. Such cases as the following, however, tend to show that even this reflex is wanting in cases of complete destruction of the upper cord.

This case is that of a woman now in Dr. Richardson's service. She fell down a flight of stairs, striking the head. Immediate loss of power in both upper and lower extremities supervened and there was numbness to the second rib and including the arms. All reflexes were wanting; *not even a Babinski was present*.

The line of numbness in this case is of interest. In case of

dorsal fracture the line of numbness about the trunk follows the fracture up to within about two spinal segments, as was illustrated in the first case cited. When, however, the fracture is in the cervical region, the line of numbness on the trunk rises no higher than the second rib. The reason for this is that the spinal segments above the second dorsal send their supply down the arm,

FIG. II.



Fracture of fifth cervical vertebra. Darker portion shows area of anesthesia.

as shown in the diagram (Fig. III). All the segments of the cord, then, which go to make up the brachial plexus (namely the fifth, sixth, seventh and eighth cervical, and the first dorsal) supply the arm. The supply of the neck begins with the fourth cervical segment. It follows that the area supplied by the fourth cervical impinges directly upon that supplied by the second dorsal. The line of numbness in our case of cervical fracture would indicate that the lesion was at the level of the fifth cervical segment.

The height of lesion in this case is shown also by the motor paralysis. In case the level of the injury has been between the fifth and sixth segments, a not uncommon level to suffer, the arms assume a characteristic position, namely, raised above the head, with the elbows flexed. This is because the deltoid and biceps, whose supply originates above the lesion, are still active, while the muscles extending the arm, and drawing it to the side (triceps, pectoralis major and latissimus dorsi) are paralyzed (Fig. IV).

In some cases this posture is replaced in a few days by one in which the arms are dropped to the side and can no longer be raised.

FIG. III.

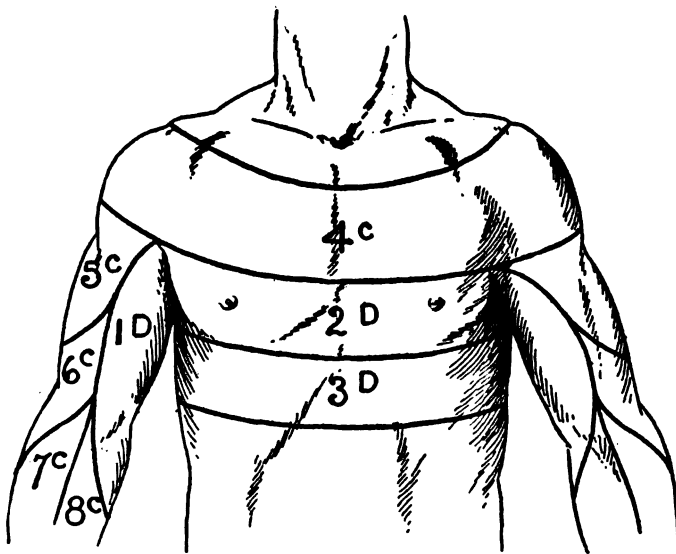


Diagram showing how the brachial segments of the cervical region send their distribution down the arm, thus making the area supplied by the fourth cervical contiguous with that supplied by the second dorsal.

This indicates the extension of softening upwards so as to include the fifth cervical segment.

In our case the arms could not be raised from the side from the first. This indicated, then, that the lesion was as high as the fifth cervical segment, a diagnosis corroborated by the anæsthesia, which reached to the shoulder.

Operation in this case was not advised, since the crush of the cord was obviously complete, and since the pain in moving the neck was insufficient to warrant operating merely for its relief.

In such cases as the first of those here reported, the prognosis for life would be good (apart from the unusual complication of the ruptured vessel) for several years, perhaps longer, depending largely upon the condition of the bladder. The prognosis in the case of the cervical fracture is much more serious. Such patients as a rule live only a week or two. The otherwise hopeless prognosis of these cases justifies operation in all, but little is to be expected from operation, and I am not inclined to advise it in cases

FIG. IV.



Position of arms in case of destruction between fifth and sixth cervical segments. (After Theoburn).

with symptoms pointing to complete crush, except when the pain on movement is so extreme as to demand relief during the short time the patient has to live.

The question of operative interference in fracture of the spine has been much discussed, but is of academic rather than of practical importance. In point of fact it is probably justifiable, in the face of so desperate a condition, to operate in every case, to give the patient the benefit of the possible chance of relief from pressure, as well as to remove such fragments of bone as may cause pain. On the other hand the conservative surgeon is doubtless justified

in leaving every case alone, fortifying himself by the argument often advanced, that few cases can be cited in which it is certain that operation is to be credited with such improvement as may have supervened.

The rule I have followed is first to advise no operation in case of extreme displacement of the spine. In other cases I advise operation when there is extreme pain at the point of fracture as well as in cases showing, in the parts below the fracture, some remains of sensation, motion or reflexes, showing that the crush is not complete.

In the case of cervical fracture above cited, no operation was advised or undertaken, because there was no special pain, and the signs pointed to complete crush of the cord.

In the case of dorsal fracture, on the other hand, operation was advised, and would have been performed had the patient lived, because there was exquisite pain at the point of fracture, and because there was still some motion of the toes and some preservation of sensation in the lower limbs.

# Pathology

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## THE WAY OF INFECTION IN TUBERCULOSIS\*

BY LAWRENCE F. FLICK, M.D.

of Philadelphia

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THE solution of the question of the way of infection in tuberculosis is of great importance from both the theoretical and practical point of view. Upon it hinges in some degree correct treatment and proper methods of prevention. Unfortunately the subject is a difficult one and for the present the question cannot be settled definitely. We are getting more and more light however and the final solution of the problem is not far off.

It seems to me that perhaps the subject has been made too broad and that much of the misunderstanding is due to this indefiniteness. The question should really be circumscribed to whether the tubercle bacillus enters the system by way of the lymphatics or grows directly upon the mucous membrane of the respiratory tract on which it lodges and from there spreads into the parenchymatous tissue. The terms "inhalation" and "entrance by way of the alimentary canal" are misleading inasmuch as entrance by the lymphatic system into the circulation can take place either way. For this reason, moreover, experiments which have been made can be interpreted for either side of the question according to the mental attitude of the individual. No experiment so far with which I am familiar absolutely excludes entrance by one or the other route through the lymphatic system.

Personally I am entitled to speak from the clinical point of view only. At the Phipps Institute over which I have the honor to preside, as in other scientific institutions, we are struggling with this problem experimentally, but as yet we have no conclusion to

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\* Discussion of the way of infection in tuberculosis at the conference on tuberculosis in Vienna, September 19-21, 1907.



announce. Perhaps we can make some announcements later. For a long time however I have held very definitive views upon this subject, formulated upon physiological grounds and clinical observations. As far back as 1887 I had reached the conclusion that the natural way of entrance of the tubercle bacillus was by way of the alimentary canal, and I then took the position that entrance by this route was the usual method. I more recently modified my view somewhat upon this subject on account of experimental and pathological work done by others and in my paper read by title at the Hague last year, I took a middle ground, namely that the tubercle bacillus enters by both routes, but always through the lymphatic system.

Physiologically it does not seem possible for the tubercle bacillus to enter the system except through the lymphatics, whether the portal be the respiratory tract, the alimentary canal or the skin. Above all it is difficult to understand how it can grow upon the mucous membrane of the respiratory tract and penetrate into the tissue of the lungs except through the lymphatics. The anatomical construction of the body and the physiological action of the respiratory tract militate at every point against such a mode of entrance and development.

Clinical observations strongly support the view that the tubercle bacillus enters the system by way of the lymphatics and it is gratifying to see how well these clinical observations are backed up by experimental work. The slowness of the development of tuberculosis, the long period of latency, the apparent resistance of the average individual to implantation, all point to lymphatic invasion. The experiments related here by Flügge give us the explanation of the apparent resistance of individuals, the long latency of the disease and the slowness of development after the disease has been established. What Flügge found in the laboratory occurs exactly in every day life. In the family in which tuberculosis exists different members of the family take in doses of tubercle bacilli which they at first resist, but which gradually, by cumulative force, overcome resistance. A latent period of tuberculosis springs up which develops into activity sooner or later in one or the other according to the accidental amount of tubercle bacilli taken in and the individual condition of general health. Some go under rapidly,

some resist a long while, and some get well and throw off the bacilli altogether. In all the process is usually a slow one.

Fortunately for preventive medicine we have enough light upon the mode of entrance of the tubercle bacillus, to enable us to lay down definite and adequate laws for prevention of tuberculosis. Whether the tubercle bacillus is sucked into the respiratory tract with the air we breathe or is carried into the alimentary canal with the food we eat, matters not so that we prevent its getting in. The way to do this is to destroy it the moment it goes out from an old host before it can get into a new one. In practical life this can be accomplished to a very great degree by cleanliness. Undoubtedly the most prolific source of new implantation of tuberculosis is the broken down tissue given off by advanced cases of phthisis and if this broken down tissue is disposed of immediately when given off without contamination of person, place or thing, practical prevention of tuberculosis is accomplished. The working out of this in every day life has been well illustrated at the Phipps Institute and we publish in the third volume of our report a carefully prepared statistical article upon the subject covering the first three years' work of the Institute.

In the part of Philadelphia in which the Institute has done most of its work during these three years there has been a phenomenal reduction in the death rate from tuberculosis, although this is the part of the city in which the death rate has always been high, whilst in the part of the city in which little work has been done and in which the well-to-do reside there has been either very little reduction, no reduction or an increase. The Phipps Institute treats the poor and teaches them cleanliness. It takes dying cases into the hospital and brings earlier cases under close supervision and accurate discipline in their homes. Every particle of broken down tissue is disposed of in such a way as to prevent infection or contamination. The results of the Institute's work seem to indicate that these measures are sufficient for the practical prevention of tuberculosis.

## ETIOLOGY OF HÆMOGLOBINURIC FEVER

BY WM. H. DEADERICK, M.D.

of Marianna, Arkansas

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ETIOLOGICALLY, hæmoglobinuric fever stands in the same relation to malaria as do tabes and dementia paralytica to syphilis. This striking analogy may even be extended to the therapeutic relations: in malaria and syphilis we possess specifics which are relatively useless in their respective "para-affections."

*Etiology.*—Hæmoglobinuric fever is chiefly a disease of the white race. The negro is not absolutely immune though a few observers of wide experience have not seen cases in this race. This relative immunity can be explained only by natural selection. Chinese imported into blackwater fever regions are almost as susceptible as whites. According to Daniels<sup>1</sup> imported Indians are only about one-fourth as susceptible as whites. Creoles are not infrequently attacked. Masterman<sup>2</sup> reports that it is not uncommon among the Jews of Palestine.

Males are more often stricken than females, the latter being less often exposed to malarial infection. In the temperate zone the proportion of affected males to females is about 3 to 1. As we approach the equator the difference becomes wider owing to the relatively small number of susceptible females. Cardamatis<sup>3</sup> believed that pregnancy conferred immunity. Krauss,<sup>4</sup> however, has reported a case in a pregnant woman who made a tedious recovery after abortion. I<sup>5</sup> have recently published notes of a case occurring in the practice of a colleague. The woman aborted on the third day of the disease and died on the fourth.

Probably more cases occur in the third and fourth decades of life. Especially is this true in the tropics. Going from the equator a considerably larger per cent. of cases in the young is encountered.

Like malaria the disease occurs in the tropics without marked seasonal prevalence, though probably commoner in the transition period from the moist to the dry seasons. In the temperate zone

it occurs at the height of, or immediately following, the malarial season, the second half of the year showing by far the greater number of cases.

Tomaselli believed in a well marked family tendency, having seen cases in several members of the same family. Daniels<sup>6</sup> refers to three families in which he noticed this predisposition. Three such families are known to me.

An idiosyncrasy in susceptible individuals has long been assumed, and by many passively accepted as the sole explanation of the mysteries of pathogenesis. What is meant by this vague term is probably a condition of equilibrium between hæmolysin, resulting from malarial influence, and anti-hæmolysin.

One who has had blackwater fever is apt to have recurrences. In the tropics about one-fourth the subjects have more than one attack. Several tropical physicians record repeated attacks in themselves. Thus, F. Plehn<sup>7</sup> had five attacks, Crosse<sup>8</sup> at least ten severe attacks, and Banks<sup>9</sup> twelve or thirteen. There is, therefore, no active immunity, the only immunity, except natural, being conferred by prolonged residence in an endemic focus.

Length of residence in the home of the disease is an important factor. A curve showing the number of first attacks to each year of residence would rise from the first to the third years and then fall gradually. This is almost constant for observations in the tropics, but is less noticeable in temperate regions. The following table of cases seen in the tropics will illustrate this point:

	1st yr.	2d yr.	3d yr.	4th yr.	5th yr.	later.
Burot and Legrand, <sup>10</sup> 100 cases..	6	22	43	20		9
Daniels, <sup>6</sup> 114 cases .....	21	40	27	12	5	9
Berenger-Feraud, <sup>11</sup> 185 cases....	10	42	79	37	9	8
Vedy, <sup>12</sup> 51 cases.....	5	7	28	5	2	4
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	42	111	177	74	16	30

Fifty cases observed by McElroy<sup>13</sup> in the Mississippi Valley were distributed as follows: two in the first year of residence, three in the second, six between the second and fifth, twenty-three between the fifth and the tenth, eleven between the tenth and twentieth, and five after twenty years.

Only exceptionally are cases seen after but a short period

of tropical residence, as Plehn's<sup>14</sup> Case No. 35, after two months in Cameroon, and one of Brem's<sup>15</sup> cases after two months on the Isthmus of Panama. The case showing the longest period of residence before onset, in which this is specified, is that of Howard,<sup>16</sup> twenty-three years in Central Africa, though in five of McElroy's<sup>13</sup> cases the length of residence was longer than twenty years.

Hæmoglobinuric fever is often considered a disease of the lowlands though cases are often observed at a height of 3,000 feet. Daniels<sup>6</sup> observes that while the greater number of cases occur in the Highlands of British Central Africa, a correction for relative population and place of residence two weeks prior to onset would give the distribution of cases per 10 of population as follows: 1.04 in the highlands, 7.28 at the level of Lake Nyssa, (about 1500 ft. altitude), and 3.8 in the Lower Shire Region.

Change of residence is not an uncommon occasion for an outbreak, especially if the difference in altitude or climate is decided. This factor seems to be independent of the hardships of travel.

Cases occurring after leaving the endemic region have been observed in England by Hughes,<sup>17</sup> Sylvain,<sup>10</sup> Crosse,<sup>18</sup> Daniels,<sup>6</sup> Manson,<sup>19</sup> and Parker;<sup>20</sup> in Ireland by Mowbray;<sup>21</sup> in Germany by Schlayer,<sup>22</sup> A. Plehn,<sup>23</sup> Kleine,<sup>24</sup> Koch<sup>25</sup> and F. Plehn;<sup>26</sup> in France by Vincent,<sup>10</sup> Boisson,<sup>27</sup> Troussaint<sup>27</sup> and Laveran;<sup>28</sup> in Belgium by Dryepondt and Vancampenhout,<sup>29</sup> and Bertrand,<sup>30</sup> and in Baltimore by Brem.<sup>15</sup> Many of these cases were not mere relapses, indeed, in the majority in which the number of previous attacks is specifically stated, they were first attacks. The onset may occur from a few days to five months or more after leaving the endemic area. Inclement weather and fatigue seem to be factors in some of these cases. The mortality is low.

Occupation which predisposes to malaria predisposes to black-water fever.

Of occasional causes, exposure to cold and dampness is probably the most efficacious, the disease in this respect showing some analogy to paroxysmal hæmoglobinuria. Over-exertion precedes some cases. The influence of alcohol has probably been over-estimated. Trauma has a slight etiological importance. Thus Mould<sup>31</sup> mentions a case developing after a sprained ankle;

Plehn<sup>32</sup> refers to one in which a man was wounded and bled considerably. Crosse<sup>33</sup> and Plehn<sup>14</sup> saw cases immediately following confinement. Psychical states as anger, grief and fear, and exposure to sun, fatigue, excessive venery, syphilis and the mercury cure have been mentioned as occasional causes. Cardamatis<sup>27</sup> lays stress on the association with the rheumatic diathesis, twelve of his thirty cases being rheumatic. Kanellis<sup>34</sup> concurs in this opinion. Alexander Haig<sup>35</sup> believes there is an intimate relation, most probably causative, between an excess of uric acid in the blood and hæmoglobinuric fever. He makes the unfounded statement that the ordinary acid sulphate of quinine is about one-fifth xanthin, which is physiologically and pathologically equivalent to uric acid, and herein, he believes, lies the supposed power of quinine to produce hæmoglobinuria. Johnson<sup>36</sup> holds that a meat diet predisposes to blackwater fever.

It may be said with almost absolute certainty that previous infection with malaria is essential. In fact a majority of careful observers make this unqualified assertion. The extreme rarity of cases in which preceding malarial infection is denied almost forces us to the conclusion that it may have been overlooked as might occur in latent or masked infections. It is however not impossible that hæmoglobinuria may exceptionally accompany the first outburst of malaria, as in the cases of F. Plehn,<sup>14</sup> Goltman and Krauss,<sup>37</sup> and Brem.<sup>15</sup> In all of the cases of Tomaselli and Koch, the most ardent advocates of the quinine theory, there was a history of antecedent malaria.

*Pathogenesis.*—There are three chief theories as to the nature of hæmoglobinuric fever:

- I. That it is malaria.
- II. That it is quinine poisoning.
- III. That it is a disease *sui generis*.

Against the malarial nature of hæmoglobinuric fever may be urged the following objections:

1. The parasites are often absent; when present they are not numerically proportionate to the severity of the attack and usually disappear as the disease progresses; sporulation does not correspond in time with the symptoms; hæmoglobinuria may be associated with different forms of the malaria parasite.

2. In malaria very numerous parasites may be present without producing hæmoglobinuria.

3. The geographical range does not coincide with that of malaria.

4. Its seasonal prevalence does not correspond with that of malaria.

5. Blackwater fever is not amenable to quinine.

The frequency with which the parasites are found is shown by the following list of examinations by various observers. The first column of figures shows the number of examinations made, the second the number in which the parasites were present:

Kanellis <sup>28</sup>	20	10
Bignami and Bastianelli <sup>29</sup>	2	1
Vincent <sup>10</sup>	5	1
Dryepondt and Vancampenhout <sup>30</sup>	1	0
Powell <sup>42</sup>	11	5
Koch <sup>41</sup>	16	2
Hanley <sup>43</sup>	13	0
Cardamatis <sup>3</sup>	25	4
Burns <sup>44</sup>	3	3
Boisson <sup>37</sup>	3	3
Troussaint <sup>37</sup>	7	5
Pezopoulos and Cardamatis <sup>37</sup>	7	3
Ketchen <sup>44</sup>	1	1
Masterman <sup>3</sup>	1	1
Schlayer <sup>33</sup>	1	1
Ollwig <sup>45</sup>	15	6
Stephens and Christophers <sup>46</sup>	16	3
Daniels <sup>6</sup>	16	4
Wellman <sup>47</sup>	1	1
Crosse <sup>48</sup>	1	1
Brem <sup>18</sup>	14	2
Krauss <sup>4</sup>	11	7
McElroy <sup>13</sup>	23	9
Thin <sup>49</sup>	1	0
Kleine <sup>34</sup>	15	6
Hoffman <sup>45</sup>	3	2
Curry <sup>50</sup>	2	0
Howard <sup>16</sup>	1	0
Ruge <sup>51</sup>	1	1
Goltman and Krauss <sup>37</sup>	12	4
Woldert <sup>52</sup>	1	1
Hartsock <sup>53</sup>	1	0
F. Plehn <sup>14</sup>	33	22

As stated in the first objection the parasites when present tend to disappear as the disease progresses. The following figures show the difference in results of examination at different periods: The great frequency with which they are found the day before the attack should be noted.

*Stephens and Christophers:*<sup>54</sup> Day before the attack parasites present in 95 per cent. of the cases. Day of attack parasites present in 70 per cent. of cases. Day after attack parasites present in 20 per cent. of cases.

*Mannaberg:*<sup>55</sup> Day before attack parasites present in 95.6 per cent. of cases. Day of attack parasites present in 63 per cent. of cases. Day after attack parasites present in 17.1 per cent. of cases.

The reasons for the rapid disappearance of the organisms are, first, that often quinine has been taken before the examination; secondly, that in the terrific hæmolysis the weaker cells, including those containing parasites, are usually the first to succumb.

The hæmoglobinuria occurring in Texas fever of cattle is cited, with some show of reason, as an argument for the purely malarial origin of blackwater fever. There are essential differences, however, in the occurrence of blackwater in malaria and in Texas fever. First, malaria is followed by blackwater in a very small percentage of cases, malaria being common, hæmoglobinuric fever much rarer; in Texas fever blackwater is a common symptom occurring in nearly all severe cases. Secondly, in blackwater fever in man the number of parasites shows no proportion whatever to the severity of the disease. In Texas fever, on the other hand, as shown by Smith and Kilbourne,<sup>56</sup> the number of the parasites is in direct relation to the severity of the process and increases as a fatal termination approaches. In human malaria the parasites may exist in very large numbers without the development of hæmoglobinuria; this is not the case in Texas fever. Bonome<sup>57</sup> found in the ictero-hæmoglobinuria of sheep the same relation between the number and behavior of the hæmatozoa and the intensity and progress of the attack as obtains with Texas fever.

The form of parasite found in blackwater fever is, in the great majority of instances, the estivo-autumnal. Only exceptionally is hæmoglobinuria combined with infections with the



benign organisms. The tertian parasite has been observed in cases of Van der Horst,<sup>58</sup> Hughes,<sup>17</sup> Koch,<sup>40</sup> (5 cases), A. Plehn<sup>59</sup> (3 cases), Ollwig,<sup>45</sup> McElroy,<sup>18</sup> Goltman and Krauss,<sup>37</sup> Brem,<sup>15</sup> Herrick,<sup>60</sup> and Curl<sup>60</sup> (3 cases). The quartan parasite has occurred in cases of Vincenzi,<sup>11</sup> Grocco,<sup>11</sup> Kleine,<sup>24</sup> and Otto.<sup>6</sup> Thiroux<sup>27</sup> and Laveran<sup>28</sup> are said to have found the large form of parasite but whether tertian or quartan is not stated. The fact that parasites other than the estivo-autumnal have been found is no argument against the malarial nature of blackwater fever, since cases of pernicious malaria in which only the large tertian parasites were found have been reported by French,<sup>62</sup> Éwing<sup>63</sup> (2 cases), Ziemann<sup>64</sup> and others.

Some writers as Grocco,<sup>38</sup> Quennec,<sup>65</sup> Rho,<sup>66</sup> Dryepondt,<sup>10</sup> Thin,<sup>49</sup> Crosse,<sup>48</sup> F. Plehn,<sup>7</sup> Bertrand<sup>30</sup> and others believe that in addition to the mechanical destruction of the red cells by the parasites, which in itself might account for the hæmoglobinuria, the parasites give off toxins which have hæmolytic powers. Toxins, the product of the malarial parasite, while rather generally assumed, have not been demonstrated.

The number of cases in which the parasite is found, if the examination is made early, constitutes conclusive evidence of an intimate relationship to malaria. This, however, is not all. The testimony furnished by the parasites is corroborated by the two subsidiary evidences of malaria, first, pigmented leucocytes, secondly, a mononuclear leucocytosis. Given therefore the presence of parasites in the first hours of the attack, and the almost constant finding of pigmented leucocytes and the mononuclear leucocytosis, it is impossible to deny that malaria plays an important rôle in its production.

The peculiarity of the geographical distribution of hæmoglobinuric fever is no argument against its malarial nature. While it does not occur in all, even highly malarial countries, it is not met except in markedly miasmatic regions. Neither does the distribution of quartan fever or some forms of pernicious fever coincide with that of malaria in general. Nor is the slight difference of seasonal prevalence of any weight. The different forms of malaria have different seasons of prevalence, as "spring tertian" and "estivo-autumnal."

The fact that hæmoglobinuric fever does not respond to quinine is one of the strongest evidences that it is not an attack of malaria *per se*.

My opinion of the relation of malaria to blackwater fever is that the former is essentially and solely the predisposing cause and that in some cases it may also act as the exciting cause.

Tomaselli first published his observations as to the etiological relation between quinine and blackwater fever in 1874. More recently Koch has directed attention toward it. The widespread controversy that followed the publication of Koch's views was bitter in the extreme; the matter was even aired in the London lay press. The misunderstanding was probably due to two causes, first, ignorance of Koch's utterances at first hand, secondly, the somewhat non-committal manner in which he expresses his ideas of the relation to malaria. While he is very emphatic in saying that blackwater fever is not an attack of malaria, he is not clear as to the predisposing rôle of the latter. He does not even assert that quinine is the exciting cause in all cases but admits that although he saw no case of blackwater fever in which quinine could be excluded he does not go so far as to maintain that every case of blackwater fever is quinine poisoning. There is no doubt but that this acrid dispute was productive of dire results inasmuch as it brought the specific into discredit, not only with the laity but with many of the profession. Even yet it is necessary in some places, on account of a fear of hæmoglobinuria to disguise quinine before it can be given.

Tomaselli was able to collect from the literature only 102 cases of quinine hæmoglobinuria.

That quinine has the power to provoke hæmoglobinuria in predisposed individuals is maintained by Murri,<sup>67</sup> F. Plehn,<sup>82</sup> Laveran,<sup>28</sup> Ruge,<sup>68</sup> Calmette,<sup>10</sup> Myers,<sup>10</sup> A. Plehn,<sup>69</sup> Kanellis,<sup>40</sup> Koch,<sup>41</sup> Foustanos,<sup>70</sup> Cardamatis,<sup>8</sup> Mannaberg,<sup>55</sup> Karamitsas,<sup>71</sup> Theophanidis,<sup>71</sup> Pampoukis,<sup>71</sup> Chomatianos,<sup>71</sup> Grocco,<sup>71</sup> Vincenzi,<sup>71</sup> Bastianelli,<sup>71</sup> Ughetti,<sup>71</sup> Cervello,<sup>71</sup> Galvagno,<sup>71</sup> Moscato,<sup>71</sup> Macleod,<sup>72</sup> Ross,<sup>101</sup> Low,<sup>101</sup> Ketchen,<sup>44</sup> Ollwig,<sup>45</sup> Stephens and Christophers,<sup>54</sup> Kleine,<sup>24</sup> Wellman,<sup>47</sup> Blair,<sup>74</sup> Tomaselli,<sup>11</sup> Kohlbrugge,<sup>75</sup> Wittrock,<sup>45</sup> Wendland,<sup>45</sup> Monneret,<sup>11</sup> Duchassaing,<sup>11</sup> Briquet,<sup>11</sup> Kohlstock<sup>11</sup> and others.

The objections to the quinine theory are:

1. Hæmoglobinuria is restricted in geographical range and is absent from some highly malarial localities where much quinine is used.

2. Hæmoglobinuria does not follow the administration of quinine for maladies other than malaria.

3. In a considerable number of cases the antecedent use of quinine can be eliminated with certainty.

4. The same individual may have an attack following the administration of quinine and later take it without harmful results.

5. The severity of the attack bears no relation to the size of the dose.

6. One dose of quinine could not cause intermittent hæmoglobinuria.

7. The great majority of cases recover even under the continued use of large doses of quinine.

Objections 1, 2, and 6 go to demonstrate that other and probably more important factors than quinine are at work even in cases often attributed to it. Objections 4 and 7 are not potent if we assume that only a portion of the erythrocytes are susceptible to the effects of quinine and that all these are destroyed by the first dose. Objection 5 proves that in cases where an outbreak occurs after quinine it cannot be regarded as mere poisoning. The third is the strongest argument against the theory that all black-water fevers are cases of quinine poisoning. That quinine is not always the exciting cause is fully attested by the numerous cases in which no quinine had been given as observed by F. Plehn,<sup>7</sup> A. Plehn<sup>23</sup> (22 cases), Marchiafava,<sup>40</sup> Celli,<sup>40</sup> Bignami,<sup>40</sup> Bastianelli,<sup>40</sup> Van der Scheer,<sup>40</sup> Beyfuss,<sup>40</sup> Seal,<sup>76</sup> Powell,<sup>40</sup> Von Diesing,<sup>40</sup> Schellong,<sup>40</sup> Laveran,<sup>28</sup> Quennec,<sup>40</sup> Navarre,<sup>40</sup> Reynolds,<sup>40</sup> Carre,<sup>40</sup> Etienne,<sup>40</sup> Sims,<sup>40</sup> Donny,<sup>40</sup> Dryepondt,<sup>40</sup> Mense,<sup>40</sup> Rothschild,<sup>10</sup> Fluit,<sup>10</sup> Rudolph Plehn,<sup>77</sup> Dempwolff,<sup>77</sup> Brin,<sup>77</sup> Crosse,<sup>48</sup> Stalkart,<sup>78</sup> Hopkins,<sup>79</sup> Cargill,<sup>80</sup> Mould,<sup>81</sup> Daniels,<sup>80</sup> Hoffman,<sup>45</sup> Rankin,<sup>81</sup> Thin,<sup>49</sup> Cardamatis,<sup>27</sup> (32 cases), Moffatt,<sup>82</sup> Schlayer,<sup>22</sup> Curry,<sup>50</sup> McElroy,<sup>83</sup> DuBose,<sup>84</sup> Hearsay,<sup>85</sup> Theophanidis<sup>27</sup> (10 cases), Koryllos<sup>27</sup> (8 cases), Yofe,<sup>27</sup> Ziemann,<sup>27</sup> Brem,<sup>15</sup> Doering,<sup>7</sup> and Shropshire<sup>86</sup> (15 per cent of his cases).

Hæmoglobinuric fever occurring only in malarial subjects and

quinine being specific for malaria, it is but a most natural sequence of events that a large number of cases have developed after the administration of quinine. The bare fact that blackwater fever often follows quinine is weak evidence for quinine etiology in the face of the numerous cases in which previous quinine could be absolutely excluded. When, however, attacks can be produced repeatedly at will by a dose of quinine the question assumes a very different aspect. Such cases are those of Murri,<sup>67</sup> Hoffmann,<sup>45</sup> Manson,<sup>78</sup> Ketchen,<sup>44</sup> Hopkins,<sup>79</sup> Bertrand,<sup>80</sup> A. Plehn,<sup>28</sup> Ollwig,<sup>46</sup> Marsden,<sup>87</sup> Daniels,<sup>6</sup> Koch,<sup>41</sup> Kleine,<sup>24</sup> Tomaselli,<sup>11</sup> Vincenzi<sup>11</sup> and Grocco.<sup>11</sup>

As stated above there is no relation between the amount of quinine and the intensity of the attack. Ketchen<sup>44</sup> precipitated an attack experimentally with one and a half grains. This patient stated that one-eightieth of a grain had previously produced blackwater. Karamitsas,<sup>27</sup> Kanellis,<sup>27</sup> Pampoukis,<sup>27</sup> Chomatianos,<sup>27</sup> Moscato,<sup>27</sup> Koch,<sup>27</sup> A. Plehn,<sup>28</sup> Kleine,<sup>24</sup> Boxer,<sup>88</sup> Shropshire<sup>88</sup> and others report outbreaks elicited by less than one-half gram. Marchiafava and Bignami<sup>89</sup> state the minimum quantity as one-twentieth gram, Laveran<sup>28</sup> as one centigram and Ruge<sup>68</sup> as one milligram.

The time intervening between the administration of quinine and the onset of hæmoglobinuria is almost uniformly fixed by various observers as from one to six hours. With six hours as the maximum interval the cases really due to quinine would dwindle considerably.

It is believed by some writers that quinine hypodermically does not produce blackwater even in persons susceptible when administered orally. This however is not the case. Kohlbrugge<sup>76</sup> thinks that only the inorganic salts of quinine are toxic and states that the tannate even in the largest doses given to susceptible persons fails to cause hæmoglobinuria. It is probable that neither the mode of administration nor the preparation used, if absorbed, gives any difference in results.

The rôle of quinine in hæmoglobinuric fever is probably highly complex. It has been shown that it is of value as a prophylactic when systematically employed;<sup>28</sup> if not thus used and malarial infection is permitted to occur, it may, in some persons, thus pre-

disposed, act as the exciting cause. In the attack itself it is possibly of value in destroying the parasites when these are present or it may act harmfully in aiding hæmolysis.

Even after a careful study it is not easy to define precisely the respective potency of malaria and quinine as etiological factors. To quote Shropshire:<sup>86</sup> "To establish the cause of any disease we must apply the agent to the subject and have, as uniform result, the disease. But if there are two agents suspected as causative which applied together produce the disease, but applied separately to the same individual, the one produces it, the other never, we can attribute only to the one a causative place and to the other an accidental presence. Such is the case before us. Malaria taken as a cause and applied without quinine to an individual of such tendency hæmoglobinuria results in 15 per cent. of the cases before us. Quinia has been applied to probably all of the cases before us without the presence of malaria and no hæmoglobinuria resulted. Which produces it?"

Favoring malaria as against quinine we have: 1. Antecedent malaria essential. 2. Relative immunity of the negro. Racial immunity to disease is well known; racial susceptibility to drugs, rare or unknown. 3. Occurs often without previous administration of quinine.

We may safely conclude that the predisposing cause is always malaria; the exciting causes are fresh malarial invasion, quinine or other medicaments, exposure, exertion, mental states, etc.

The most enthusiastic champion of the view that blackwater fever is neither malaria nor quinine poisoning but is a disease *sui generis* is Sambon.<sup>90</sup> Mason<sup>91</sup> formerly advocated this theory. The two reasons for his belief are a similarity to paroxysmal hæmoglobinuria and an analogy to Texas fever. Stalkarrt,<sup>78</sup> Rho,<sup>92</sup> Vincent,<sup>10</sup> and others believe that it is a distinct disease. While the similarity to paroxysmal hæmoglobinuria cannot be denied the relation to Texas fever is, as we have seen, far from close, and the evidence that it is a disease *sui generis* is inadequate.

Yersin<sup>93</sup> found certain bacilli in the casts and epithelium of the urine of two patients and believed he had discovered the cause of the disease. Breaudat,<sup>94</sup> however, showed that these were the *bacillus coli communis*.

Collett<sup>95</sup> has recently and without grounds suggested that there may be a causal relation between the *bacillus megatherium* and blackwater fever.

The theory that green beans and their blossoms were the cause of many cases of hæmoglobinuric fever seems to have perished in Greece, Sicily and Sardinia where it originated.

It is generally conceded that hæmoglobinuric fever consists of a destruction of red blood cells so widespread that the liver, being powerless to transform the liberated hæmoglobin into bile pigment the greater part is excreted by the kidneys. This conversion into biliary coloring matter is the physiological fate of free hæmoglobin and indeed its pathological destiny up to a certain limit—which according to Ponfick's postulate is the destruction of one-sixth of the entire number of red cells—beyond which hæmoglobinuria ensues. This much seems to be unanimously accorded. The nature of the hæmolysin is the missing link in the pathogenetic chain.

The modern study of immunity and cytolysis has thrown a flood of light on hæmolysis. Founded on data from this source Bignami<sup>96</sup> formulates his theory as follows:

1. An alteration in the plasma which is affected little by little as a consequence of a specific change in the red blood corpuscles through which a certain number of them come to behave in respect to the organism like the corpuscles in the blood of another species of animal; 2, the formation in consequence of this change of a substance in the plasma which is capable under certain conditions of becoming hæmolytic.

My hypothesis which has been elaborated elsewhere<sup>96</sup> will only be reviewed here. According to this theory the pathogenesis may be divided into the following stages: 1, erythrorrhæxis; 2, hepatic stimulation and production of amboceptors; 3, action of complement; 4, hæmolysis and hæmoglobinuria or the formation of an anti-hæmolysin.

1. This primary blood destruction is due directly to the malarial parasite, chiefly through the act of sporulation, possibly also by the production of a toxin, though this has not been demonstrated. The hæmoglobin thus liberated is carried to the liver, where it is elaborated into bile pigment. We have seen that this erythrorrhæxis is insufficient to account for hæmoglobinuria.

2. On reaching the liver the hæmoglobin is acted on by certain of the molecules or atom groups of the liver cells which have an affinity for it, certain receptors of the liver cells having the property of transforming free hæmoglobin into bile pigment. When these receptors are exhausted the deficiency is met by overproduction. When the cell becomes over-filled some of these side-chains are cast off into the general circulation. Here the receptor becomes an amboceptor.

3. Having gained access to the general circulation the amboceptor meets the complement which is present in normal serum and the complete hæmolysin is formed. The nature of the complement is unknown but certain facts throw suspicion upon lecithin, or its derivatives. Bile, an hæmolysin, is rich in lecithin; there is overproduction, stasis and resorption of bile. The surface diffusion membrane of the red cells contains a large proportion of lecithin; the lecithin compound with saponin is powerfully hæmolytic; when the stroma of corpuscles hardened in formalin has its lecithin removed with ether, saponin seems to have no effect.<sup>97</sup> Friedmann<sup>98</sup> obtained hæmolytic lecithids from pancreatic fistulæ. Kyes<sup>99</sup> using the amboceptors of cobra venom produced a complete hæmolysin, "cobra-lecithid," by activation with lecithin. It cannot be said with certainty, however, that lecithin is the complement of the hæmolysin in blackwater fever.

4. The reaction of amboceptor with complement, if not antagonized by an antihæmolysin, causes an hæmolysis, which, if sufficiently extensive, results in hæmoglobinuria. It is highly probable that when the production of the hæmolysis does not proceed with too great rapidity there is formed *pari passu* an antihæmolysin which may exactly balance the hæmolysin without destroying it. This is probably the symbiosis referred to by Krauss.<sup>4</sup> So long as the equilibrium between hæmolysin and antihæmolysin is maintained no hæmolysis occurs, but should this equilibrium be greatly disturbed by such conditions as fresh malarial invasion, quinine, exposure, fatigue or other, probably unknown factors, hæmolysis occurs and hæmoglobinuria ensues. Under this exact equilibrium the subject may be said to possess idiosyncrasy, and is in a condition very similar to that of paroxysmal hæmoglobinuria.

Casagrandi<sup>100</sup> has recently found in malarial blood an hæmolysin the presence of which is masked by an antihæmolysin.

It is possible that a slight and temporary loss of equilibrium may result in a limited hæmolysis producing hæmoglobinæmia but not hæmoglobinuria. In this way may be explained some cases of anæmia, cachexia and post-malarial secondary fever in which the parasites, if present, are not in proportion to the results.

It is believed that this hypothesis explains the occurrence of hæmoglobinuric fever during and after malarial infection, with or without the administration of quinine; it explains why the malarial attack may precede by months the appearance of blackwater; why exposure, exertion, etc., may elicit an attack; why the hæmolysis does not always coincide in time with the sporulation of the parasites in the cases in which the latter are present; it accounts in a measure for the complex relation with quinine and explains obscure anæmia, quinine fever, post-malarial secondary fever and post-hæmoglobinuric fever. Lastly, it coincides with the prevalent ideas of tropical physicians of an intimate relation between hæmoglobinuric fever and "biliousness."

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# Progress of Medicine

DURING THE YEAR 1907

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## TREATMENT

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### Infectious Diseases

**TYPHOID FEVER.**—Chantemesse (*L'Hygiène Gén. et Appliquée*, October, 1907) publishes another encouraging report on the value of *antityphoid serum in typhoid fever*. He states that in the 1,000 patients subjected to his method of treatment during the past six years the mortality was 4.3 per cent., while the mortality in the 5,621 patients treated in the other hospitals of Paris during this period was 17 per cent. Hydrotherapy was employed in all cases in addition to the serum treatment. In the hands of Brunon and Josias this method gave equally good results, and at the military hospital of Val-de-Grace there were but five deaths in 90 cases so treated, the mortality for the preceding six years, before the introduction of the serum treatment, being 10.6 per cent. Chantemesse emphasizes the importance of using the serum as early as possible, stating that he has never seen a fatal result when the patient received the serum within ten days of the onset of the disease.

The serum is obtained from horses, which for long periods have been inoculated with typhoid toxins in the form of filtered and sterilized cultures of typhoid bacilli grown on bouillon of beef spleen. The dose of the serum is from one to five drops, hypodermically. After the injections there follows a period of reaction in which the temperature is frequently somewhat elevated. The general condition is not improved during this reaction, which lasts from a few hours to several days. Chantemesse regards this phenomenon as the result

of the destruction of the bacilli in the body and the consequent liberation of an additional amount of toxin. The opsonic index is found to be increased to a greater degree in severe infections than in mild ones, and for this reason Chantemesse advises using a minimum dose of the serum in severe cases, as the greater the bactericidal power of the blood, the greater will be the reaction. After the reaction comes a period of defervescence. The pulse is slowed, the blood pressure is raised, the quantity of urine is increased, the spleen is enlarged, and the patient feels much more comfortable. The temperature usually continues to fall for ten or twelve days, when it may remain stationary for a few days and then go on to a rapid lysis or a mild relapse. The influence of the serum seems to have been exhausted by this time, and a second injection may be required.

Lieutenant Luxmore (*British Medical Journal*, June 22, 1907), of the British Army, presents a very favorable report on *antityphoid vaccination*. In August, 1905, he inoculated with sterilized cultures of typhoid bacilli 150 men belonging to the 17th Lancers, prior to their departure for India. With the exception of 23 who refused to accept a second dose, all of the men received two inoculations. India was reached on September 28, 1905. Less than two months afterwards the regiment suffered from outbreak of typhoid fever, during which 63 cases were recorded. Only two of these occurred amongst those who were inoculated, and these two were in men who had refused the second dose of vaccine, which is considered necessary in order to confer the full measure of protection. Commenting on the result, Leishman points out that since the ten inoculated persons served unintentionally as "controls," the evidence in favor of the protective effect of the inoculations is very striking.

S. Bauch (*Medical Record*, October 13, 1906) thinks that the *Brand method* is the ideal treatment in a large proportion of cases of typhoid fever in private practice, but that there are many cases in which it is contraindicated. Cold baths prevent lethal complications by reason of their sustaining effects on the central nervous and circulatory systems. The method of application of the bath must depend on the individual case. Each application must be followed by a reaction and not depression, so as to sustain nerve force and prevent exhaustion. It is important that this treatment be begun early, as it is a preventive measure. The temperature of the baths should be gradually lowered until it reaches 70°F. The bathing should be coupled with friction and repeated only during the waking hours once in four hours.

M. Manges (*New York Med. Jour.*, December 1, 1906) believes that the *diet in typhoid fever* should be suited to the taste and condition of the patient, the state of the tongue, mouth, abdomen, etc. The use of a fuller diet is justified both from theoretical and practical standpoints. First, the long duration of the disease renders it imperative that the general nutrition of the patient should be kept up to the highest standard to sustain life and prevent complications and secondary infection as far as possible. Second, the diet must be palatable and must be of such character that the patient can relish and digest it and also that it can provide for the loss of tissue resulting from the febrile process. Third, the diet should be so regulated that no harm results to the patient on account of the peculiar anatomical lesions.

Hoesslin has proved that the febrile temperature of typhoid fever is not increased by the quantity of food taken. Furthermore, Klemperer and others have shown that the larger quantity of food given is properly digested in spite of the fact that most of the glandular secretions are diminished and the motility of the stomach more or less weakened. The stomach functionates well, provided the food is not given in too large quantities, and provided the deficiency of hydrochloric acid is made up by the administration of acid or by sterilizing the food. As regards intestinal digestion in typhoid fever, Klemperer has proved that nearly 90 per cent. of 100 grammes of fresh, easily digestible fat is absorbed, and 91 per cent. of 100 grammes of albumin is absorbed. As to carbohydrates, they are seldom found in the *fæces* unless excessive quantities have been taken. It is important, however, that all articles of food be thoroughly cooked, carefully minced, or strained, and as sterile as possible. The patient must thoroughly masticate the food. Furthermore, the liberal diet must not be given to all patients. The rule already given is a simple one—if the patient desires more food, the quantity and variety may be safely increased.

Kinnicutt (*Boston Med. & Surg. Jour.*, October 9, 1903) gives the following comparative table of the results from *liberal diet* and from *fluid diet* in typhoid fever:

LIBERAL DIET	
Cases .....	733
Relapses .....	48
Percentage basis of 325 cases, 11.38.	
Hæmorrhage .....	35
Percentage basis of 733 cases, 4.77.	

Perforation .....	10
Percentage basis of 733 cases, 1.36.	

Mortality .....	60
Percentage basis of 633 cases, 9.47.	

## FLUID DIET

Cases .....	4,654
Relapses .....	507
Percentage, 10.89.	

Hæmorrhage .....	411
Percentage, 8.83.	

Perforation .....	111
Percentage, 2.40.	

Mortality .....	491
Percentage, 10.55.	

PNEUMONIA.—W. P. Northrup (*Jour. American Med. Assoc.*, October 13, 1906) strongly advises the *open-air treatment of pneumonia* and concludes: The cases most favorably affected by this treatment are those with severe poisoning with delirium, partial cyanosis, or deep stupor. Open air may be secured by screening off the bed and a portion of the room next the window. No cases have been injured, and a few have been much aided, possibly saved, by the cold fresh air treatment. The only regulation is to make the patients comfortable, keeping their feet warm especially. The ears, nose, and hands may get cold without harm. G. E. Rennie (*British Med. Jour.*, August 31, 1907) has adopted the open-air treatment in every case of acute pneumonia occurring in the Royal Prince Albert Hospital, Sydney, N. S. W., during the last ten months. No unfavorable symptoms of any kind were observed. The temperature never rose above 103.8°F., the crisis was never delayed beyond one week, and almost immediate improvement was observed in the pulse so that rarely was a cardiac stimulant necessary. He has no hesitation in recommending the general adoption of the treatment. Burt (*Medical Record*, March 30, 1907) also speaks favorably of the open-air method of treatment.

H. M. Murray (*British Medical Journal*, June 8, 1907) makes the following remarks concerning the treatment of pneumonia in children. To maintain an adequate state of nutrition and to conserve the patient's strength, feeding must be carried out with the utmost regularity. The food should be diluted too much rather than too

little. Poultices are an unmixed evil. A child has enough to do to raise its ribs sixty times a minute without being obliged to raise a heavy linseed meal poultice as well. The use of ice-bags and the abstraction of blood may be of value in adults, but are not to be employed in children. A free supply of fresh air is of prime importance. Inhalations of oxygen may be a substitute for this, but it is a poor one. Steam kettles are worse than useless. The room should not be lighted by gas, since its products aggravate the cough. Drugs have little influence, except so far as they act as stimulants to the circulation or respiration. They are needed at the first suspicion of circulatory or respiratory failure. They comprise strychnine, ammonium carbonate, spirits of ether, sparteine, and alcohol. Expectorants are only of use when the accompanying bronchitis is severe; otherwise they should be avoided. Caution the friends against exciting and exhausting the patient and be always on the lookout for the earliest signs of any complication. The desire to avoid worrying a patient is often a temptation to be slovenly in one's examination of an affected organ.

Edsall and Pemberton (*Amer. Jour. Med. Sci.* February, 1907) record notes of three cases of *unresolved pneumonia treated by X-rays*, in which marked improvement took place. They state that no results are to be expected unless the condition has been of only a few weeks' duration, since organization of the exudate precludes the possibility of resolution. In selecting cases it is important to choose those in which the condition is a lack of resolution and not a continued inflammation, and the possibility of tubercle must be eliminated. Treatment should be begun tentatively with brief exposures and small doses, since a sudden digestion of the exudate and absorption of its products during a severe toxæmia might be harmful. In the three cases so treated there was a rapid clearing up of all signs of consolidation, which had previously persisted for one month, two weeks, and thirteen days respectively. The effect on metabolism was most remarkable, there being an increased metabolic output through the urine, while the exudate became moist and rapidly cleared up. Theoretically the rays, in their action on ferments normally present, excite or accelerate the processes that digest the exudate.

SCARLET FEVER.—B. Shick (*Berlin klin. Woch.*, 1907, xliv, No. 23) consigns every patient with scarlet fever, no matter how mild the attack, to bed for four weeks, and during this time he is not given any meat. The diet consists of milk, milkfoods, light farinaceous foods, bread, butter, soups not made of meat stock, honey and pre-

serves. Cold packs control the fever. Antipyretics are condemned. Warm baths are not permitted until the fifth week. The body is anointed with vaselin or vaselin-lanolin during the stage of desquamation. If angina is severe, cold applications are made to the neck, and older patients are advised to gargle with a solution of from 1 to 2 per cent. hydrogen peroxide. Cold drinks are also given when the angina is severe. Under no circumstances is the patient permitted to leave his bed until one week after albumin has disappeared from the urine, and the author insists on making a daily temperature record until the sixth week of the disease.

Deléarde (*L'Echo Méd du Nord*, January 20, 1907) is of the opinion that an entirely milk diet is contraindicated in scarlet fever because milk contains a large quantity of sodium chloride, and an excess of this salt throws more work on the already-damaged kidneys. Treatment by a *chloride-free diet* aims at resting the kidneys and is beneficial in acute nephritis from any cause. The author quotes cases of scarlatinal nephritis, with oedema, hæmaturia, albuminuria and casts, in which all the symptoms rapidly disappeared when the patient was put upon a chloride-free diet. There is large selection of food-stuffs poor in chlorides, especially if one has recourse to the hydrocarbons, which are nourishing and non-toxic. Another advantage attaching to the chloride-free diet is that the digestive disturbance and constipation so often accompanying a prolonged period of absolute milk diet are entirely avoided. The chloride-free dietary contains soup, eggs, cream, purées of vegetables, nuts, sweet-meats, fats, and bread made without salt. The urine should be examined daily, and should albumin appear the nitrogenous foods should be cut down and hydrocarbons substituted for them. The treatment must be continued for several weeks to be effective.

Thompson (*Edinburgh Med. Jour.*, 1907, xxi, 103) states in regard to the use of a prophylactic drug against the nephritis of scarlatina that *urotropin* is the only one which has proved itself of value. Of 47 consecutive patients treated with this drug by the author not one had nephritis and only one exhibited albuminuria. These facts he considers encouraging enough to suggest the further use of the remedy. In conclusion, he suggests that all patients with scarlet fever be given from the beginning 5 grain (0.3 gm.) doses of urotropin three times a day for a child up to twelve years; for patients above this age  $7\frac{1}{2}$  grains (0.5 gm.) thrice daily are advised. Generous dilution of the drug with water is necessary and the treatment should be continued to the end of the fourth week of the disease.



**INFLUENZA.**—W. Broadbent (*Practitioner*, January, 1907) considers *quinine* the best remedy in influenza. As a prophylactic he gives 2 grains (0.13 gm.) every morning during the prevalence of the epidemic. In the treatment of the disease his usual prescription is one dram of ammoniated quinine, and two drams of liquor ammoniæ acetatis, every hour for three hours, and then every four hours. J. Moore (*Practitioner*, January, 1907) recommends for the severe pains of influenza a combination of sodium salicylate with granular effervescent caffeine citrate; or phenacetin, 3 to 5 grains (0.2–0.3 gm.); tincture of gelsemium, 5 minims, and chloroform water, ½ ounce (15 c.c.). When the cough is dry and paroxysmal, Hector Mackenzie (*Practitioner*, January, 1907) gives heroin hydrochloride in doses of 1–36 to 1–12 of a grain (0.0018–0.005 gm.) at intervals of from one to two hours. When the cough is very frequent and severe he employs the following:

Morphinæ hydrochloridi	gr. ½	(.03)
Apomorphinæ hydrochloridi	gr. ¾	(.045)
Acidi hydrochloridi diluti	℥ xx	(1.25)
Syrupi pruni virginianæ	fʒss	(15.0)
Aquæ	fʒii	(60.0)

Fl. tinct. Sig. One teaspoonful as necessary.

When there is bronchitis a mixture containing ammonium citrate, potassium citrate, and ipecac wine is useful:

Liquoris Ammonii citratis	ʒiiss	(6.0)
Potassii citratis	gr. xv	(1.0)
Vini ipecacuanhæ	℥ v	(0.3)
Aquæ	fʒi	(30.0)

Sig. One teaspoonful three times a day.

**DIPHTHERIA.**—A. Terribile (*Gaz. degli Ospedali*, 1907, xxviii, 18) states that he made 2,500 *preventive injections of diphtheria anti-toxin*, each about 300 units, during a recent epidemic of diphtheria. The immunity conferred lasted from nineteen to twenty days as a rule. In case circumstances required it he then repeated the injection and again after forty days. Out of 2,000 individuals thus treated 17 contracted diphtheria, but none died. The ages ranged from a few days to 20 or 30 years. His experience with antitoxin in treatment of 528 cases of declared diphtheria was also extremely satisfactory. The mortality was 2.08 per cent. No inconveniences

were observed in any case, although albuminuria was noted in 75 per cent. of the patients.

R. Emmerich (*Münch. med. Woch.*, 1907, liv, no. 45) calls attention to the value of *pyocyanase* in the treatment of infectious diseases, especially diphtheria. Pyocyanase is a bacteriolytic enzyme obtained by passing three weeks' old cultures of *B. pyocyaneus* through a Berkefeld filter and reducing the filtrate to one-tenth its volume in a vacuum. The substance thus derived not only dissolves pyocyaneus bacilli but also various other bacteria. This remarkable bactericidal action of pyocyanase has been utilized in therapeutics, and Escherich, Pfaunder, Jehle and others have obtained results in diphtheria and other infections which seem to justify the belief that pyocyanase is destined to play an important part in the treatment of these affections. Guinea-pigs injected with a fatal dose of diphtheria toxin recover after an injection of pyocyanase. It seems to bind the diphtheria toxin and also dissolves the false membrane. In the treatment of diphtheria Emmerich insufflates 3 or 4 c.c. of pyocyanase into the throat through a hand atomizer operated by blowing into the connecting tube. The spraying is repeated four times at a sitting, with intervals of from 5 to 10 minutes, to allow the enzyme to act on the bacteria and false membrane. The diphtheritic process, it is said, is arrested at once, the promptness depending on the energy with which the throat is sprayed. Other observers also report favorable results even without the aid of antitoxin. Zucker's report of 35 cases emphasizes the rapid disappearance of the fetor, the subsidence of the fever, and the solution of the false membrane. Emmerich adds in conclusion that a failure to use pyocyanase now in diphtheria—always in connection with antitoxin treatment—seems to him as criminal as omission of antiseptic measures in case of infected wounds.

Ker and Croom (*Edinburgh Med. Jour.*, 1907, vi, 487) have employed *formic acid* in 412 cases in diphtheria, with the result of diminishing the death rate by 1.8 per cent. over that of the previous year. Previously strychnine had been given as a heart tonic, but in 1906 formic acid in 25 per cent. aqueous solution, in doses of 5 to 20 minims (0.3–1.2 c.c.) every four hours, was substituted, the dosage being graduated rather by the severity of the infection than by the age of the patient. No change in the heart action was noted until after forty-eight hours, and then the change was rather a negative one, that is to say, many of the severe infections did not show the expected cardiac weakness and irregularity; on the other hand, the pulse in many instances was much improved, as was the color of the

skin and the general nutrition. Patients were observed who appeared doomed to die of heart-failure, but who rallied. This manifestation being attributable to the possible limiting effect of the formic acid upon the degeneration of the heart-muscle or its beneficial action on the undamaged muscular tissue. The most striking result of the treatment was the diminution of the number of instances of paralysis, the percentage being only 2.9, as against 9.09 in the previous year, which was the lowest in several years. If this diminution of paralysis is really due to the formic acid, the point is raised why a muscular tonic should have such a result on a lesion usually regarded as primarily of nervous origin. They conclude that the results obtained are distinctly encouraging, particularly in relation to the occurrence of cardiac failure and paralysis. Formic acid is, at least, an admirable tonic; it is safe and may be employed to the advantage of the patient.

WHOOPIING COUGH.—T. W. Kilmer (*Archives of Pediatrics*, February, 1907, and *Jour. of Amer. Med. Assoc.*, November 23, 1907) states that in the three years which have elapsed since he first announced his treatment of whooping cough with an *abdominal belt*, the recorded cases show conclusively that about 95 per cent. of cases are positively benefited. This is especially true, he asserts, in regard to cessation of vomiting. The first belt was composed of a long strip of silk elastic placed over a stockinette band; this, while efficacious, was nevertheless warm to the child and expensive to the parents. The new belt is made of linen with a strip of silk elastic webbing two inches wide inserted on either side. This is sufficient to give the belt elasticity, yet does not add materially to its weight. The belt laces in the back, and, by means of the lacings, any degree of constriction may be maintained. It is worn over the undershirt or band. The width should approximately be as follows: For infants, 4 to 5 inches wide, for children 5 to 8 inches wide. The length should be such that when complete it should measure three inches less than the circumference of the abdomen at the navel. The degree of constriction should be determined in each individual case; usually a slight constriction is sufficient to produce a moderation of the cough and a complete cessation of vomiting. If, after the belt is applied the symptoms do not abate, it should be tightened slightly. These belts can be made by any instrument maker at a few hours' notice. They are best applied by the attending physician, and the parents and nurse should be instructed in their use. It is a mistake to suppose that all that is necessary to obtain a beneficial result in any given case is to procure some sort of a constricting abdominal binder and give it to the

mother or nurse to apply. In discussing Kilmer's paper Douglass, of Detroit, and Kerley, of New York, both endorsed the value of the belt as a therapeutic measure.

Recently certain French clinicians have asserted that *vaccination* seems to have a beneficial action on pertussis, and, in fact, may prove curative in a considerable proportion of cases. Attention was drawn to this point by Amat in a communication to the Société de Thérapeutique in April, 1907, and since that time Bolognesi and Laborderie (*Bull. Gén. de Thérap.*, October 23, 1907) have published studies on the subject which tend to corroborate this view. Bolognesi holds that if the child has been previously successfully vaccinated, a revaccination is of no therapeutic value in pertussis, but Amat and Laborderie have both obtained good results whether it was the first vaccination or not if the vaccination was successful. Their combined experience shows that in a fairly large proportion of cases children having pertussis who are successfully vaccinated experience a marked improvement within a day or so of the development of the pustule and are completely cured in one or two weeks. The rationale of the procedure has not yet been explained.

**CEREBROSPINAL MENINGITIS.**—M. Többen (*Münch. Med. Woch.*, 1907, liv, No. 49) reports sixty-six cases of cerebrospinal meningitis at Bochum. The mortality in thirty-seven cases treated by lumbar puncture alone was 56.7 per cent., while it was only 16.6 per cent. in 12 cases in which *serum treatment* was begun the first or second day of the disease. The death rate grew constantly higher the later the serum treatment was instituted, the total mortality in the twenty-nine serum-treated cases being 34.5 per cent.

**MALARIA.**—Grosch (*Medizin Klin.*, May 19, 1907) suggests the use of *atoxyl* (meta-arsenic anilide) in malaria when intolerance to quinine is present or when its use bids fair to be dangerous, as in blackwater fever. He reports a case in which it was used after quinine had to be discontinued on account of hæmorrhage from the gums and petechiæ, which promptly recurred when quinine was taken. Under the use of small doses of *atoxyl*, from  $\frac{1}{6}$  to  $\frac{1}{2}$  grains (0.01–0.1 gm.) the bleeding ceased and the malarial attacks disappeared. Nearly two years afterward the same patient was again attacked with malaria, which was uninfluenced by the smaller doses, but disappeared under the use of 3 grains (0.2 gm.) hypodermically. G. Fusco (*British Medical Journal*, October, 1905) also reports three cases of malaria in which *atoxyl* subcutaneously proved superior to quinine.

**RHEUMATISM.**—R. Stockman (*British Medical Journal*, November 24, 1906) discusses the action of *salicylic acid* in the treatment of rheumatism. This substance seems to be a true specific and exerts an antitoxic and probably also a bactericidal action on the causative agents of the disease. The action is more energetic when the bacteria are in the blood or in the joints than when they have settled in the fibrous tissue or in the valves of the heart. The obvious lesson is to attack the disease promptly by the use of sufficient doses while the infection is still located in the joints and before the heart and fibrous tissue have become involved. Doses of 16 to 20 grains (1.0–1.3 gm.) once in three hours, 90 to 120 grains (6.0–8.0 gm.) a day, are usually sufficient. If not it is desirable to give an additional dose of 40 to 60 grains (2.6–4.0 gms.) or to increase the single dose so as to give as much more per day. The various derivatives of salicylic acid—salicin, aspirin, etc.—are not so active as sodium salicylate. The effective dose of salicyl compounds cannot be given at times on account of the ringing in the ears or other poisonous symptoms. When these symptoms present themselves, however, the heart is seldom much affected.

E. Steinitz (*Zeitschrift f. klin. Med.*, 1907, lxiv, No. 2) reports his experience with 175 patients treated by *constriction hyperæmia*, with and without the salicylates. The application of the constricting band almost invariably relieved the pain. A large number of patients recovered in from 4 to 20 days, as early as those treated with salicylates. Even if the Bier treatment fails to cure, it can scarcely ever do harm. Complications seemed less frequent and milder than under exclusive salicylic medication. In case moderate temperature persists unmodified after the fifth day under the Bier treatment, Steinitz advises the administration of salicylates, as also when the affection changes rapidly from joint to joint. In case of recent endocarditis he advises restricting the salicylates as much as possible and relying mainly on the constricting band. The Bier method of treating local inflammation referred to by Steinitz consists in applying an elastic band, about two and one-half inches wide around the limb above the lesion. The bandage should be tight enough to make the skin red, but should not interrupt the arterial circulation. It should not cause pain. It should be worn an hour or two once or twice a day. If the skin becomes tender, the position of the bandage should be changed.

J. Bodenstein (*Berlin. klin. Woch.*, April 8, 1907) has tested the new salicylic preparation, *benzosalin*, which is made by combining salicylic and benzoic acids. It is a tasteless white powder, insoluble

in cold water, slightly soluble in hot water, and freely soluble in alcohol, ether and chloroform. It is claimed for benzosalin that it is not dissociated until it reaches the intestine, so that gastric disturbance is avoided. The cases which the author subjected to the action of benzosalin included four severe and four mild cases of acute articular rheumatism, several cases of muscular and nerve rheumatism, sciatica, neuralgia and lumbago. The effect in all the acute rheumatic cases was exceedingly good. The dose was 6 tablets a day gradually increased to 10 tablets, each tablet containing 8 grains (0.5 gm.) of the drug. He has not met with any unpleasant side-effects and is entirely satisfied with the results obtained.

TETANUS.—Jacobson and Pease (*Annals of Surgery*, September 3, 1906) consider the therapeutic value of *antitoxin in tetanus*, basing their conclusions on 203 tabulated cases. Of these cases, 108 were treated by subcutaneous injections, 64 by injections into various internal structures, 12 by intraspinal injection, 16 by intramuscular injection, 2 by intracerebral, and 1 by intravenous injection. From the facts presented, the authors believe that after tetanus is fully established, serum therapy, however administered, promises but little as a curative agent. The method of intracerebral injection has nothing particularly to commend it as a means of reaching either the free toxin or that fixed to the cells of the nervous system. Moreover, it is not devoid of danger, as one case has been recorded in which frequent repetition of the injection was followed by cerebral abscess. The injection of antitoxin into the subdural space offers but little prospect of reaching the affected nerve cells, because of the protection afforded by the pia mater. The injection of antitoxin into the cord or cauda equina in the small number of cases in which it has been tried resulted in three recoveries, but in one of these there was an incubation period of 16 days, and the disease ran a mild course. Attempts to neutralize the toxin present in large nerve trunks by the intraneural injection of antitoxin have not been satisfactory, as such injections can be of no benefit except when tetanus is localized. Only the toxin in a given nerve can thus be neutralized. In concluding their paper, the authors, while acknowledging the failure of serum therapy in tetanus, point out that as a prophylactic measure the injection of antitoxin merits the fullest confidence. In an editorial upon the value of *antitoxin in tetanus prophylaxis* the *Journal of the American Medical Association* for August 17, 1907, it is stated that a fairly careful scrutiny of the American literature of the past five years has not brought to light a single report of the development of

tetanus in a person who had received a timely prophylactic dose of antitoxin.

At the end of 1906 Suter (*Beitr. z. klin. Chir.*, 1907, lii, 694) was able to collect from the literature 22 cases of unsuccessful prophylactic use of tetanus antitoxin. Analysis of the reports shows, in the greater number of instances, evident reasons why the remedy was ineffective. In a few there was too long an interval between the time of infection and the time of injection of the antitoxin, in a few there was evidence that the antitoxin was inactive, a few others followed dusting the wound with dry antitoxin powder, a method which is highly unreliable because of the uncertainty of absorption; and in one case tetanus did not appear until forty-seven days after the accident and thirty-nine days after the antitoxin injection, when the immunity had presumably disappeared or had been greatly diminished. In Geneva in one clinic 700 prophylactic injections have been given with but one mild case of tetanus and many other hospitals and clinics have furnished equally favorable reports. Berger (*Bull. et Mém.*, November 18, 1907) in discussing the preventive treatment of tetanus before the Société de Chirurgie of Paris, stated that in his own hospital practice during the past seven years preventive injections had been made in all cases of injury likely to result in tetanus, and particularly in wounds soiled by contact with earth or complicated by the introduction of some foreign body. The only case observed in the course of this long trial was one in which the wounded subject had not been treated by preventive injections. A study of the few recorded cases of failure shows, it is pointed out, a much reduced mortality, and favors the view that preventive injection, if not an absolute guarantee against the development of tetanus is a cause of attenuation and of diminished gravity of this complication.

The new standard unit of tetanus antitoxin, adopted by the committee of experts appointed by the Society of American Bacteriologists, went into effect April 1, 1907. The unit is ten times the least amount of serum necessary to save the life of a 350-gramme guinea-pig for 96 hours, against the official test dose of the standard toxin. The test dose is 100 minimal lethal doses of a precipitated toxin prepared under special conditions at the Hygienic Laboratory of the Public Health and Marine-Hospital Service. The minimum immunizing dose in case of possible infection through a wound should be 3000 of such units.<sup>1</sup>

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<sup>1</sup> *Jour. Amer. Med. Assoc.*, May 18, 1907.

Meltzer and Auer (*Jour. of Exp. Med.*, December, 1906) have studied the effects of *intraspinal injection of magnesium sulphate* on tetanus in 8 monkeys and 3 human subjects. A 25 per cent. solution was used. All the monkeys died, but those treated lived twenty-four to forty-eight hours longer than the controls. One patient recovered. The authors conclude that intraspinal injections of magnesium sulphate, in doses which do not affect the respiratory center or other vital functions, are capable of abolishing completely all convulsions in tetanus. The relaxing effects of the drug may last twenty-four hours or longer. They believe that the value of the injections lies in the possibility, by abolishing all muscular contractions, of tiding over the subject until the newly formed antitoxin can overtake the balance of free toxin and the metabolic processes of the body have mastered the toxins fixed by the nerve cells. Blake (*Surg. Gynecol. and Obstet.*, 1906, ii, 541) reports a case of severe tetanus, with an incubation period of seven days, in a boy in whom antitoxin was used without benefit and in which magnesium sulphate, 4.5 c.c. of a 25 per cent. solution, was intraspinally injected on the fifth, seventh, ninth, tenth, and sixteenth days, with excellent results the patient making a complete recovery. Almost total suspension of symptoms resulted from each injection. In another very severe case, however, Blake observed no effects from the treatment. Logan (*Jour. of the Amer. Med. Assoc.*, 1906, xlii, 1502) has employed the injections in two cases but without benefit. Franke (*Centralbl. f. innere Med.*, No. 14, p. 345) reports a rather mild case in which the injections were followed by recovery, and Robinson (*Jour. of the Amer. Med. Assoc.*, August 10, 1907) cites another case in which the treatment was employed with success.

**TUBERCULOSIS.**—The important studies of Wright on the opsonic index of the blood in infectious diseases has revived the interest of the profession in the treatment of pulmonary tuberculosis by *tuberculin immunization*. Koch did not regard his original tuberculin as an immunizing agent, but considered the healing obtained as the result of a local reaction in and about the tuberculous area. Now, however, the essential action of all the various tuberculins is held to be the stimulation of the defensive resources of the organism and the production of probably both antitoxic and antibacterial immunity. The three best known preparations of tuberculin are Koch's original tuberculin, known as T.A., which is a sterile glycerin extract of the bodies of tubercle bacilli; Koch's "new tuberculin"—T.R., which consists of a suspension of pulverized tubercle bacilli after extraction with



normal saline solution, with an addition of an equal volume of glycerine. The tuberculin of Deny's (1905) is practically identical with Koch's original tuberculin. As a result of a recent study of the subject, Bandelier and Roepke (*Lehrbuch der spezifischen Diag. u. Therap. de Tuberk.* Wurzburg, 1908), physicians to the sanatoriums at Cottbus and Melsungen, strongly advocate the use of these tuberculins both for diagnostic and therapeutic purposes. They argue that the various medicinal, dietetic and hygienic methods of treating tuberculosis are all admirable and give a certain percentage of cures, but they hold that the specific method is superior to all others. Its limitations are now so well recognized that it should be employed not only in sanatoriums, but also by the general practitioner. The authors recommend that patients in the early stages of tuberculosis, and who are free from fever should begin with injections of 1-10 mg. of old tuberculin, and this quantity can be gradually increased until 1000 mg. are given in a single injection. In severe cases the injection should not be more than 1-1000 mg., and it will often be found impossible to raise the dose 10 or 100 mg., in such patients without producing a harmful reaction. The injections should be kept up so long as the patient shows improvement or he is cured. New tuberculin, T.R., is regarded as the mildest of the bacillary preparations and therefore suitable for the treatment of patients who are unusually sensitive to T.A. It is contraindicated in advanced lung disease. The initial injection should be 2-1,000 mg. and the maximum dose should not exceed 20 mg. Here again the dose should never be large enough to cause a definite immediate reaction. Bandelier and Roepke regard the new tuberculin bacterial emulsion as the most active of Koch's products, and recommend as an initial dose 1-10,000 mg. This amount should be gradually increased to 10 mg., always avoiding, however, any immediate subjective or objective reaction.

Trudeau (*Amer. Jour. Med. Sci.*, June, 1907) describes the two methods of using tuberculin: the laboratory and the clinical. The laboratory method is based essentially on determinations of the opsonic index as elaborated by Wright. In this case the dose of tuberculin remains minimal throughout the course of the treatment, which has met with most success in chronic localized tuberculosis elsewhere than in the lungs. The clinical method is controlled solely by the clinical course and manifestations. He emphasizes the importance of beginning with small doses (1-1000 mg. of old tuberculin) and thus avoiding definite reactions. These doses are then gradually increased, the interval between the injections being four or five days. If no

intolerance develops it may require from six months to a year or longer before a high degree of tuberculin immunity is reached. If evidences of increasing sensitiveness appear, the injections should be stopped for a time, then commenced with smaller doses. In this way a dose of 1 c.c. may ultimately be tolerated with advantage. In addition to the favorable impression gained from watching patients thus treated, Trudeau points to his statistics, which show that of the patients treated with tuberculin from 18 to 25 per cent. more were alive than of those not treated with tuberculin during the past fifteen years.

Hammer (*Muench. med. Woch.*, November 27, 1906) concludes from his experience with old tuberculin, extending over six years, that if it is not a certain cure, it at least does much more than any other remedy. As a general rule, he starts with 1-100 mg. in mild afebrile cases, but in less favorable cases he starts with 1-1000 mg. The object is just to avoid a reaction. Roemisch (*Münch. med. Woch.*, January 15, 1907) believes that a carefully carried out tuberculin treatment is capable of yielding better results for certain classes of tuberculous cases than any other form of treatment. Luedke (*Zeit. f. Tuberc.*, vol. ix, No. 2, 1906) and Rosenberg (*New York Med. Jour.*, October 26, 1907) also speak favorably of tuberculin treatment. On the other hand, Squire (*British Medical Jour.*, 1907, i, 1417) states that he fears we have not the cure for consumption in tuberculin, even when the dose is regulated by watching the opsonic index. He cites three patients in whom tuberculin treatment appeared to light up quiescent disease in the lungs.

Mendel (*Revue Therap.*, 1907, lxxiv, 5) is enthusiastic regarding the treatment of pulmonary tuberculosis by means of *intratracheal injections* of from 1 to 10 per cent. gomenol or eucalyptol in oil. Under this treatment the symptoms become ameliorated and the patient gains weight and strength. Of 200 patients in all stages of the disease, Mendel reports 47 per cent. of apparent cures with return to active life; 33 per cent. of improvement, also with return to work, and 20 per cent. of failures. Usually the treatment must be continued for a considerable period of time.

**SYPHILIS.**—At the last meeting of the International Congress of Hygiene, Metchnikoff, Roux and Salmon (*Presse Médicale*, November 6, 1907) corroborated their previous statements in regard to the simple and easy *prophylaxis of syphilitic infection by local application of a mercurial ointment* (calomel, 33 parts; lanolin, 67 parts; vaselin, 10 parts). Unfortunately the ointment is efficacious only when em-

ployed during the first few hours after contact with syphilitic virus; hence it is useless to recommend it in cases which first come under observation some few days later.

Much attention has recently been directed to the use of *atoxyl* in the treatment of syphilis. *Atoxyl* is not the anilide of meta-arsenic acid, but the sodium salt of amido-phenyl arsenic acid. According to Metchnikoff and his colleague (*Annales de l'Institut Pasteur*, October, 1907), a single injection of *atoxyl*, delayed until the fifteenth day after inoculation of the syphilitic virus is effective in preventing the development of the disease. Hallopeau (*Bull. de l'Acad. de Méd.*, 1907, lxxi, No. 23) reports from his experience with *atoxyl* in 120 cases of syphilis that it has a powerful action on the infectious agent, but that the secondary associated infections do not seem to be influenced by the drug. If the injections could be continued long enough, he says, there is no doubt the disease might be cured, but this is not possible owing to the development, sooner or later of symptoms of intolerance—abdominal pain, vomiting, malaise, faintness, and dysuria. P. Uhlenhuth (*Deutsch. med. Woch.*, 1907, xxxiii, No. 22) asserts that *atoxyl*, in sufficiently large doses, has an unmistakable action on the manifestations of syphilis, especially of the malignant forms. The drug does not influence the movements of the spirochætes outside of the body, although it seemed to banish them from the blood completely in an infant with inherited syphilis. Six of the eleven patients exhibited symptoms of intoxication. F. Moses (*Berlin klin. Woch.*, 1907, xlv, No. 29) has treated nineteen syphilitics with *atoxyl*; five were cured and seven improved, but more or less serious by-effects were observed in all but seven cases. Neisser (*Deutsch. med. Woch.*, 1907, xxxiii, 38) writes that his experimental research on apes has shown that *atoxyl* has an unmistakable and decided action in syphilis. This is shown conclusively in the fact that apes inoculated with syphilitic virus do not develop the disease if they are treated with *atoxyl*.

Fehr (*Deutsch. med. Woch.*, 1907, xxxiii, 49) reports two cases of visual disturbances from the use of *atoxyl*, similar to the two reported by Bornemann and von Krüdener. In his two patients suspension of the drug was followed by restoration of sight, but in the other two cases the blindness persisted. Lesser and Greef have also reported two instances of temporary blindness from *atoxyl* and Koch had 22 cases of blindness in his experience with the *atoxyl* treatment of sleeping sickness, but all were under higher dosage than he now advocates. These cases show that, although *atoxyl* may ultimately

prove of some value for cases of syphilis in which mercury cannot be employed, considerable caution should be exercised in its use. The initial dose should not exceed  $\frac{3}{4}$  grain (0.05 gm.)

Rossi and Cipollina (*Gaz. degli Osped.*, 1906, xxvii, 126) review their experience with *serum treatment* in fifty cases of syphilis. Among the striking examples of its curative action is the case of a man with gummatous osteoperiostitis of the skull with extensive necrosis and a purulent discharge. The process had persisted for three years notwithstanding general and local mercurial treatment. Under serum treatment the lesion gradually healed, the patient gaining nearly 13 pounds in weight, and the bone reforming over nearly the entire surface.

### Constitutional Diseases

**DIABETES MELLITUS.**—Williamson (*Practitioner*, 1907, lxxix, 1) states that in large doses opium, morphine and codeine sometimes diminish the sugar excretion in diabetes, more especially in the mild cases; their great disadvantage is their tendency to cause constipation, and as this increases the liability of the patient to coma, these drugs do not appear to be suitable in the aggravated types of diabetes. Sodium salicylate and aspirin are often more satisfactory than opium or its alkaloids, and in mild types of diabetes may induce a diminished sugar excretion, but in the severe forms this benefit seldom occurs, although the general condition of the patient may be improved. The doses should be such as to avoid inducing toxic symptoms, and aspirin is often preferable to the sodium salt on account of its less liability to be followed by ill-effects. Bismuth salicylate is often very useful in diabetes complicated with diarrhoea. After the suspension of drug treatment the amount of sugar in the urine is only too prone to increase again. Nevertheless a certain benefit is to be attained by the administration of these agents. In the presence of diacetic acid in the urine and the imminence of coma, the alkalies, particularly sodium bicarbonate, in connection with free purgation by mercurials, may cause a disappearance of this dangerous manifestation, but at times this form of treatment is without avail, especially if the diacetic acid reaction is marked, although the alkaline medication may be of temporary service in improving the general condition and delaying the onset of coma. The amount of the salt given may be as much as an ounce or more in a day, and when premonitory symptoms of coma are present an ounce and a half may be given for several days in succession. When coma has commenced it may sometimes be dispelled

by large doses of the bicarbonate, but it is very likely to recur at a later date.

M. Labbé (*Presse Médicale*, 1907, xv, No. 82) has been studying the comparative tolerance of diabetics for *potatoes*. In six out of seven cases the starch in potatoes was much better borne than bread, and only once was the latter better assimilated than potatoes. In comparison with milk and eggs, he found that potatoes were far better tolerated, while they proved to have several advantages over wheat flour and pod vegetables. Other advantages of potatoes in an anti-diabetic diet are that they allow large amounts of butter, etc., to be incorporated with them and also the variety of ways in which they can be cooked. The amount of potatoes allowed of course should be kept within the limits of the patient's tolerance for carbohydrates.

The effect of *secretin*, an excretion of the duodenal mucous membrane, in stimulating the external secretion of the pancreas, led Foster (*Jour. of Biolog. Chemistry*, January, 1907) to try this agent in the treatment of diabetes. There was no favorable result in the nine cases, save that in one instance, while the sugar contents of the urine remained the same, the patient gained in appetite, strength and weight.

GOUT.—Alkan (*Die Therap. der Gegenwart*, 1907, i, 43) on the ground that blood serum is one of the best uric acid solvents, has applied *artificial venous stasis* according to Bier's method in the treatment of acute attacks of gout. This treatment, in connection with local applications, is followed by rapid cessation of the seizure. It is advised to associate alternate local applications of heat and cold with the treatment by stasis. The constriction of the part by the elastic band is kept up for two or three hours, the limb being elevated, and cold compresses are applied, to be followed by hot applications for an equal length of time.

A. P. Luff (*Practitioner*, February, 1907) recommends the following lotion for the pain of acute gout:

Sodii carbonatis	3iii	(12.0 gm.)
Linimenti belladonnæ		
Tincturæ opii, aa	fßii	(60.0 c.c.)
Aquæ, q.s. ad.	fßviii	(240.0 c.c.)

A small portion of the lotion should be mixed with an equal quantity of hot water, and then poured on cotton wool previously arranged around the joint. The pack should be changed every four hours. Local depletion and blistering are condemned owing to their liability of extending the inflammatory process and so leading to

ankylosis or deformity. Internally, the following pill is recommended to be taken three or four times a day after meals:

Colchicinæ	gr. 1-60	(0.001 gm.)
Extracti nucis vomicæ	gr. ¼	(0.015 gm.)
Extracti hyoscyami	gr. ½	(0.03 gm.)
Extracti gentianæ	gr. 1	(0.06 gm.)

In addition to colchicum in small doses, Luff recommends from 5 to 10 grains of guaiacum in cachets two or three times a day, in the treatment of subacute and chronic gout. For the local treatment of the joints he advises elevation of the limb, application of a light flannel bandage, and the use of hot and cold douches alternately, the Scotch douche and massage.

**RHEUMATOID ARTHRITIS.**—A. P. Luff (*British Med. Jour.*, October 26, 1907) finds that *guaiacol* and *potassium iodide* are the most useful drugs in this disease. His experience in over 3000 cases leads him to regard guaiacol as capable of arresting the disease, diminishing the size of the joints, permitting increased movement, and markedly relieving the pain. He recommends from 5 to 10 grains of the carbonate three times a day, increasing the dose from 1 to 3 grains each week, until 15 to 20 grains are taken in each dose. Superheated air and electric light baths are beneficial. Douche massage is effective. Dry heat benefits, whereas cold damp increases the disease. Seaside resorts are not suitable.

For six years, W. J. Midelton (*Lancet*, September 28, 1907) has had great satisfaction in treating rheumatic arthritis by the method recommended some years ago by Latham of Cambridge, namely, *counterirritation of the spine by blisters to the region of the lumbar and cervical enlargements*. He considers it the most useful therapeutic agent. In only one case did strangury occur, and it lasted only a few hours and yielded to copious water drinking and hyoscyamus. The irritation must be pronounced and prolonged, and applied at the right spot.

#### Diseases of the Blood and of the Ductless Glands

**ANÆMIA.**—Crile (*Cleveland Medical Journal*, March, 1907) reports the result of his observation on the feasibility of *direct transfusion of blood* in pernicious anæmia, leukæmia, cancer, chronic supuration, pathologic hæmorrhage accompanying jaundice, chronic bleeding from the bowel, and surgical shock. The therapeutic results are grouped in three classes, positive, negative, and undetermined.

VOL. I. Ser. 18—14

Among the positive results is transfusion in acute hæmorrhage, which is apparently final. In pathologic hæmorrhage it has proved positive in improving the patient's immediate condition, and in most instances wholly controlled the bleeding itself. In shock its value seems far greater than any other remedy which he has hitherto employed. From the experimental standpoint it seems to be the most effective treatment of illuminating gas poisoning. Among the negative results are transfusion in pernicious anæmia, leukæmia, carcinoma, and diphtheria toxæmia. Among the undetermined results may be mentioned chronic suppuration with its attendant debility and anæmia, tuberculous and the acute self-limited infectious diseases. Of the seventeen clinical cases all were technically successful. In every instance the donee experienced a heightened vitality. Some had chills during transfusion or soon after, and a majority showed some febrile reaction later. In case of serious disease, such as pernicious anæmia or leukæmia, the improvement in the blood picture was not maintained, as in patients having no serious disease.

P. Morawitz (*Münch. med. Woch.*, 1907, liv, No. 16) reports three cases of severe anæmia in which the condition was growing worse under arsenic and other measures but recovery promptly followed after a single intravenous injection of from 150 to 200 c.c. of defibrinated blood from another person was made. The author thinks it established that there are certain cases of anæmia in which the bone marrow is still capable of reacting and functioning, but in which the blood has become too anæmic to supply the stimulus for functioning, and that this stimulus can be supplied from without by transfusion of blood.

Pepper and Nisbet (*Jour. Amer. Med. Assoc.*, August 3, 1907) report a case of hæmorrhagic disease of unknown etiology in which fatal hemolysis occurred after two transfusions of blood from different individuals had been made. The result in this case, the authors remark, indicates that direct transfusion is not always innocuous and that some caution should be exercised in its employment until we are in possession of greater knowledge.

MYXEDEMA.—C. P. Howard (*Jour. Amer. Med. Assoc.*, April 27, 1907) closes an elaborate article on myxedema with the following remarks concerning *thyroid therapy*. It is best to begin with a small dose (one five-grain tablet, or two grains of the extract) once a day, and gradually increase in frequency and amount until the symptoms begin to subside. This stage of the treatment has to be carried out with great care in all cases in which the disease has lasted for some

years, in the aged, and in those who show any indication of arterial or cardiac degeneration. Murray advises rest in bed for a time so that as little strain as possible may be thrown on the heart or vessels. Any undue acceleration of the pulse, as an increase of from ten to twenty beats per minute, indicates over-dosage. Further, a rise of temperature of one degree above normal, vomiting or purging are also danger signals. Extreme prostration, headache, sweating, and irritability are some of the other indications of the toxic effect of the drug. After six or twelve weeks of this first stage the frequency of the dose may be reduced. The minimum dose has always to be determined by trial. Many find one tablet a day necessary while others are free from symptoms with one tablet every two or three days. If the extract be discontinued for any time, there is a return of the symptoms.

**EXOPHTHALMIC GOITRE.**—L. F. Barker (*Jour. of Amer. Med. Assoc.*, October 12, 1907) considers that the brilliant results of surgical treatment in the earlier and milder forms of this disease make it incumbent on medical men to consider operation early and seriously, though nearly all patients improve on rest, a diet which does not stimulate the thyroid (milk), sodium phosphate, and fortnightly X-ray exposures, and although occasionally a patient will get well, very many go backward again as soon as treatment is discontinued. In the very early cases surgery is capable of curing nearly 100 per cent., even in the outspoken cases almost 75 per cent. can be cured by operations judiciously planned and skilfully performed, and the mortality, now about 5 per cent., can still further be reduced. He believes that whenever the symptoms are such as to leave no doubt of a pre-existing thyreointoxication, medical treatment unless markedly beneficial should not be continued long before operation is advised. The only contraindications in uncomplicated cases are a feeble heart with very high pulse frequency or pronounced psychic excitation; when these are present a brief preliminary medical treatment may be necessary; if the serious symptoms persist in spite of it, the dangers should be pointed out and operation resorted to.

R. B. Preble (*Jour. Amer. Med. Assoc.*, October 12, 1907) believes that medical treatment should be employed in every case of exophthalmic goitre until it is seen that, in spite of rest, proper nourishment and hygiene and intelligent effort at the correction of individual symptoms, the patient is steadily getting worse. It is far better, however, to operate earlier than is necessary than to delay too long. A. Kocher (*Jour. Amer. Med. Assoc.*, October 12, 1907) summarizes



the results obtained by *operation* in 254 cases in the Clinic at Berne, Switzerland. In the last 91 operations on 63 patients there was not a single death; and in the whole number the mortality was only 3.5 per cent. There was not a single case in which the patient was not much benefited. In 83 per cent. cure resulted.

W. S. Halsted (*Jour. Amer. Med. Assoc.*, October 12, 1907) expresses his belief in the efficiency of the serum discovered by Beebe and Rogers in some cases. He saw a series of cases in which the exhibition of the serum had been followed by relief, almost complete, of the symptoms of exophthalmic goitre. The result of the surgical treatment of the disease in the Johns Hopkins Clinic has been surprisingly successful. Of some ninety patients operated on during the past fifteen years only two have died. Of the two fatal cases, one weighed only sixty pounds at the time of operation and was losing at the rate of three pounds a week. The other patient died suddenly four days after the operation, during apparent convalescence.

F. Billings (*Jour. Amer. Med. Assoc.*, October 12, 1907) states that if rest treatment thoroughly carried out results in a decided improvement, one would be justified in continuing it. If it is not helpful, or the individual financial condition or relation to the family is such that it is impossible to take rest treatment, then surgery is indicated. Although operative measures are less objectionable than formerly, if a member of his family suffered from the disease, Billings would prefer at first to try the rest treatment. In his experience with the few patients he has seen operated on, entire recovery has not occurred, as it does not occur in those managed medically.

C. H. Mayo (*Jour. Amer. Med. Assoc.*, October 12, 1907) reports 176 cases of Graves' disease operated on with 8 deaths. There was but one death in the last 75 operations. He believes that one can now look on hyperthyroidism as a surgically curable disease; not in all cases, but in those turned over to the surgeon not too late and after medical treatment has been employed for a reasonable time without relief.

P. Faber (*Hospitalstidende*, 1907, l. No. 34) has employed *X-rays* in eight cases of exophthalmic goitre with truly remarkable results in a few instances, even allowing for a spontaneous tendency to recover in some cases and the effects of suggestion in others. Widerman (*Semaine medicale*, 1906, No. 3) treated five cases of Basedow's disease without influence on the thyroid or the exophthalmus, but the nervous symptoms were much relieved in two cases, and in all, in spite of unchanged mode of living, the weight increased. Sklowdowski

(*Deutsch. med. Woch.*, August 16, 1906) has had a similar experience in one case. R. Freund (*Münch. med. Woch.*, 1907, liv, No. 17) reviews the experience of others with X-rays, citing nearly a dozen authors, and reports five cases. Unmistakable benefit occurred in all. The thyroid gland was reduced in size and the nervous symptoms disappeared. The patients all increased in weight.

#### Diseases of the Circulatory System

**CHRONIC AFFECTIONS OF THE HEART.**—Huchard (*Jour. des Prat.*, December 1, 1906) concludes that the only real active principle of *digitalis* is the crystallized digitalin [Digitaline chistallisée (Codex); Nativelle's Digitaline] and that the digitoxin of Schmiedeberg, and that of Cloetta, are not products of definite composition. There are three ways in which crystallized digitalin may be given. First, in massive doses. Fifty drops of a 1 to 1,000 solution should be given once or twice in one day in those cases where asystole is threatening, and where there are œdema, visceral congestions, deficient urinary elimination, etc. After thirty-six or forty-eight hours abundant diuresis sets in, and the cardiac contractions increase in strength, with a resulting disappearance of the visceral congestions and œdema. If the action of these doses is insufficient after an interval of eight or ten days, the same quantities may again be administered. Should the cardiac contractions still remain feeble after the disappearance of the œdema, 2 to 4 drops of the same solution may be given daily for one to three weeks after a fortnight's interval. Secondly, in small doses; these are for the dyspnoea of mitral stenosis (during compensation). From 5 to 10 drops of the same strength of solution should be given daily for five consecutive days, and then omitted for three or four weeks, when these doses may be recommenced. Thirdly, in very small doses as a cardiac tonic. From 1 to 4 drops of the solution may be given daily for weeks or months, omitting the doses every two or three weeks for one or two weeks. When a rapid action is required crystallized digitalis dissolved in oil may be injected under the skin, without any subcutaneous irritation; from  $\frac{1}{8}$  to  $\frac{1}{2}$  mg. may be so injected. The author concludes with the remark that as there are no substitutes for digitalis, so there are none for digitalin.

L. Brunton (*British Med. Jour.*, March 16, 1907) believes that the free use of *calcium salts* has a tonic action on the heart in cases in which there is a tendency to cardiac failure. He has given calcium chloride in doses of from 5 to 10 grains (0.3–0.6 gm.), dissolved in water, every four hours, with most excellent results in cases of impend-

ing cardiac failure in pneumonia. The disagreeable saline taste of the salt is covered by one minim of the elixir of saccharin. The salt has also proved efficacious in cardiac disease, when the ventricular wall appeared to be losing power. In such cases the lactophosphate or the glycono-phosphate may be employed.

G. Rankin (*British Med. Jour.*, March 1, 1907) recommends digitalis in combination with nitroglycerin in the treatment of aortic disease. He says nitroglycerin prevents increase of peripheral resistance and so robs the digitalis of that influence on the arterioles on account of which its administration is supposed to be contraindicated. Rankin is a firm believer in the use of digitalis in aortic disease when compensation fails.

H. Campbell (*British Medical Jour.*, August 17, 1907) has employed *theosin-sodium acetate* with digitalis in a number of cases of cardiac dropsy and each time with excellent results. When there is primary blockage of the lungs, as in chronic bronchitis with extreme emphysema, it is less efficacious. In the dropsy of chronic parenchymatous nephritis the theosin salt was useless, but in the cardiac dropsy attending the last stage of granular kidney its diuretic action was eminently satisfactory. In ascites from portal obstruction the salt was without effect. The drug is best given in doses of from 3 to 8 grains every four hours (0.2–0.5 gm.) in cachets. Its effects should be carefully watched, as it is apt to irritate the stomach. This is, indeed, its chief drawback.

Renon (*Rev. thérap.*, 1907, xiii, 443) has employed injections of *thiosinamine* on account of its properties in softening cicatricial tissue in cases of cardiofibrosis, valvular affections, and arterio-sclerosis. He injects from 15 to 30 minims (1.0–2.0 c.c.) of a 4 per cent. solution under the skin of the abdomen every two days. The injections are well borne and only slightly painful. In mitral lesions the results were *nil*, but in aortic affections a noticeable effect was observed, the dyspnoea being lessened and the arterial tension lowered. The physical signs remained unchanged. In arteriosclerosis the effect was less constant, but in certain patients the dyspnoea became less and the blood pressure was lowered. The action of the drug lasted from three to four months.

**ARTERIOSCLEROSIS.**—Huchard (*Bull. de l'Acad. de Méd.*, January 21, 1907) considers arterial hypertension an important cause of arteriosclerosis, and maintains that the prevention of the latter condition consists, in great measure, in combating the former. In lessening the tendency to excessive vascular tension many means are at our disposal,

the most important of which are: diet, muscular exercise, massage—particularly abdominal and precordial massage—baths—especially carbon dioxide baths—and high frequency currents. Of the drugs, the most useful are the nitrites with theobromine to assist elimination through the kidneys. Huchard regards renal insufficiency as a very important symptom of early arteriosclerosis and one that should command our best efforts for its relief, consequently we should reduce to a minimum the alimentary toxins which are the chief cause of this difficulty. Here diet regulation plays an important part, as it also does in lessening the tendency to excessive arterial tension. The ideal diet is one composed chiefly of vegetables and milk and one from which sodium chloride has, as far as possible, been eliminated. Diuretics also should be employed in order to increase elimination through the kidneys, and it may become necessary to sustain the heart in the struggle against the peripheral obstacles. Heart tonics are usually unnecessary before the condition is well advanced, but when indicated, the intermittent administration of digitalin is advised. In fine, the treatment of what Huchard calls “presclerosis” consists in lowering arterial tension, combating toxic conditions, and increasing renal permeability.

**AORTIC ANEURYSM.**—Huchard (*Jour. des Prat.*, 1906, No. 20) reports three instances of aneurysm which he has followed, two for eight years and one for four years, in two of which permanent cure has resulted from treatment calculated to reduce vascular tension below the normal. The treatment consists in keeping the patient at rest in bed and in prescribing a diet from which soups containing an excess of fats, meats, especially those cooked rare, game, fish, cheese, salted foods, tea, coffee, spirits, heavy beer, and an excess of wine are eliminated. Tobacco is also forbidden. Drugs, such as nitroglycerin, tetranitrol, and sodium nitrite, were administered. The author considers that iodides have been overrated in this connection. In syphilitic aneurysms mercurial injections are contraindicated on account of their liability to affect the kidneys and, as a consequence, to cause increased arterial tension. The milk diet in connection with theobromine, which assists in eliminating vasoconstrictor poisons, is very helpful in reducing vascular tension.

T. Oliver (*British Med. Jour.*, March 16, 1907) discusses the clinical history of thoracic aneurysm, which he believes is in at least 50 per cent. of cases due to syphilis. Rest in bed and quietude, together with a restricted diet, are mentioned as essentials in the treatment. Potassium iodid is said to give great relief, but does not

produce a cure. Speaking of galvano-puncture, Oliver says that in one case of subclavian aneurysm thus treated, the result was satisfactory, until, as the result of friction, the aneurysm redeveloped and burst into the surrounding tissue.

### Diseases of the Kidneys

NEPHRITIS.—J. Tyson (*Penna. Med. Jour.*, November, 1907) points out that in both parenchymatous and interstitial nephritis the immediate cause is an irritant, and our first duty is to recognize what that irritant is—infectious diseases, over-eating, or over-drinking (especially alcohol, tea and coffee), intestinal products, etc. Basham's mixture is too carelessly administered. Tyson gives it now less than he used to. Iron in small doses, with very small doses of bichloride of mercury freely diluted, is recommended; he also advises purgatives, the iodides as vaso-dilators, and the derivatives of the caffein group. In uræmia he recommends venesection with hypodermoclysis, purging and sweating, and high colonic injections of hot salt solution administered slowly. In œdema he advises the use of scarification and Southey's tubes. He does not think highly of nitroglycerine, but thinks it harmless and tending to relieve high tension. In the high tension of granular kidney, however, it is of signal service; 1-100 of a grain (0.0006 gm.) is given every two hours until the effect is produced. In low tension digitalis and caffein must be substituted. He accords Edebohl's operation a place in treatment, but does not consider it curative. He urges insistence on an ophthalmoscopic examination in every case of Bright's disease at least twice a year. In renal headache he advises pilocarpine nitrate, beginning with 1-12 grain (0.005 gm.), rapidly increased, to produce an effect upon the skin.

The *Journal of the American Medical Association* (April 13, 1907) in an editorial analyzes the various reports that thus far have been submitted upon the *relation of chlorides to œdema*. It is pointed out that the reports of many competent observers show conclusively that in nephritis, particularly of the parenchymatous type, retention of chlorides often occurs; yet in some typical cases it may not be possible to demonstrate such retention. In any case, however, the treatment of renal dropsy by "dechloridization therapy" seems to be warranted on several grounds. In the first place, of course, comes the indication that in many cases œdema is relieved by this means; the amount of chlorides excreted on a chloride-poor diet being much in excess of the amount taken in, such a diet soon leads to the removal of the retained chlorides and with them the retained water. Secondly,

there is considerable evidence that chlorides may act injuriously on the diseased kidneys; indeed, excessive quantities of sodium chloride may cause albuminuria even in healthy individuals. It seems to have been commonly found that nephritic patients kept on a chloride-poor diet show a decreased amount of albumin in the urine, while the administration of chlorides causes it to increase. Furthermore, there is abundant evidence that there is no danger in reducing the intake of chlorides to as low a figure as can be done by a carefully selected diet. To reduce the chlorides to such a reasonable minimum, say from 2 to 3 grammes a day, no very difficult procedures are necessary, for in eggs, unseasoned meats, and unsalted butter we have foods that are nearly salt-free, while the salt-content of milk is very low. Bread without salt, fresh water fish, potatoes, rice, fresh vegetables, fruits and chocolate offer a considerable variety of salt-poor foods that make the regulations of a dechloridization diet not intolerable to the patient.

#### Diseases of the Respiratory Tract

**CORYZA.**—Boulai (*La Clinique*, September 6, 1907) has employed *atropine sulphate* for coryza for several years, and speaks highly of its efficacy. A solution of the drug (neutral sulphate of atropine, 1 centigramme; cherry laurel water and distilled water, of each 20 grammes) is applied to the nasal mucous membrane as soon as the earliest symptoms are perceived, using for the purpose a cotton-wool swab and passing it as high as possible. The treatment is repeated every half hour at first, then every hour, if necessary, but not oftener than eight or ten times a day. The treatment may be continued (if required) for three days, not longer, and in addition small doses of aconite can be given. The treatment is only advised for early cases, and should not be used when there is nasal obstruction. A menthol ointment is of use subsequently as a sedative and disinfectant.

**HAY FEVER.**—H. H. Curtis (*Jour. of Amer. Med. Assoc.*, July 13, 1907) from his own experience and the replies to 300 inquiries draws the following conclusions concerning the treatment of hay fever or hyperesthetic rhinitis: The consensus of opinion to-day is against the claims made for pollantin, though observers who have been instructed personally by Professor Dunbar indorse unqualifiedly the great benefit to be derived from the treatment. Medically the suprarenal capsule products hold the first place. The employment of constitutional measures as an adjunct to any local application is of supreme importance. The best of all treatments yet found is the climatic, with previous attention to nasal conditions.

**HÆMOPTYSIS.**—Grace-Calvert (*Lancet*, 1907, 4362) considers *amyl nitrite* to be most valuable in practically all instances of hæmoptysis. At first it appears to be madness to give a patient, with a bleeding vessel, a drug which is a powerful vaso-dilator, but—even though the action be only transient—it produces such an immediate fall in the general blood-pressure, that the pressure at the bleeding point is lowered and there is time for clotting to take place, and the hæmoptysis usually ceases almost immediately. He uses the drug in 3 minim capsules, one of which the patient breaks, inhaling the fumes as they rise. Warning should be given that the consequent feeling of fulness in the head is of no significance.

**PLEURISY.**—F. Forchheimer (*Jour. Amer. Med. Assoc.*, January 5, 1907) considers that the longer fluid is allowed to remain in the pleural sac the greater the likelihood of the formation of adhesions, that it is a risk for the patient to go about his ordinary pursuits with the effusion, for dangerous symptoms may develop at any time, and finally if the fluid is withdrawn the process may be terminated. These Forchheimer regards as strong arguments for *early paracentesis*, and he would not wait for the occurrence of the symptoms of intrathoracic pressure. He also advocates withdrawal of the fluid in tuberculous pleurisy, since, after tapping, an artificial hyperæmia, following the pressure anæmia previously existing, occurs and good effects, as claimed for it by Bier, take place. The hyperæmia also induces a leucocytosis, which is followed by the development of fibrous tissue which tends to encapsulate the tubercle. He makes the definite statement that paracentesis should be performed eight days after compression of the lungs has existed, and as much fluid as possible should be drawn off, for the more fluid withdrawn the greater the hyperæmia.

#### Diseases of the Digestive Tract

**CHRONIC GASTRITIS.**—R. F. Chase (*Jour. Amer. Med. Assoc.*, April 20, 1907) writes that we must remove all conditions which may be considered as contributing factors. Hence, good hygiene is advised, which means regular habits as to eating, exercise and action of the bowel, repair of carious teeth, etc. Bearing in mind that starches are better digested than under normal conditions and that the proteids are poorly cared for in the stomach, we have the key to the dietetics in this disease. Cooked fat is not well borne. Alcohol is interdicted. To free the stomach of mucus and to stimulate secretion and peristalsis, douching of the stomach with a warm alkaline and saline solution is the most valuable means we possess. The douching or lavage

should be done at least twice a week, and always with the fasting stomach. The agents usually employed are sodium chloride and sodium bicarbonate, 30 grains (2.0 gm.) of each to a pint (0.5l.) of water at 100°F. The author also recommends the administration of sodium chloride and sodium bicarbonate (10 to 15 grains—0.6–1.0 gm.) of each, in a glass of warm water, fifteen minutes before meals. Sodium phosphate or sulphate may be used, especially when there is constipation. Nux vomica, condurango and other bitters may be of service, but of late Chase has rarely used them.

**GASTRIC ULCER.**—J. H. Musser (*Amer. Jour. Med. Soc.*, December, 1907) believes that in simple uncomplicated ulcer it is best to employ rest, at first absolute and later modified, a suitable diet, and the drugs indicated, for at least four months. If attended by an organic complication, as pyloric obstruction, by dilatation, if extreme, or by hour-glass contraction, surgical measures are in order. If perforation exists there should be no delay in operating. If hæmorrhage exists operation is rarely necessary, and if acute, not unless the peril of hæmorrhage outweighs that of operation. If hæmorrhage is persistent, operation is indicated. Under any circumstances and until cure is established the patient should be kept in touch with a surgeon. After an operation the patient should be treated medically for at least four months, and hygienic and dietetic treatment should extend over a period of years. A patient who has had gastric ulcer should, for all time, observe the hygienic and dietetic rules which tend to keep digestion normal, prevent anæmia, and prevent neurosis.

**DYSENTERY.**—Vaillard and Dopter (*Rev. de Thérap*, 1907, x, 331) find that *antidysenteric serum* relieves the symptoms of bacillary dysentery almost immediately and ensures a rapid recovery. The dosage in mild affections is from 5 to 7½ drams (18.5–28.0 c.c.), but in grave cases it may be necessary to inject as much as 2½ ounces (75.0 c.c.) and to repeat the dose on the following day. Skschivan and Shifansky (*Berlin. klin. Woch.*, February 11, 1907) also report very favorably on the use of antidysenteric serum.

W. R. Moulden (*Medical Record*, 1906, No. 1864) reports excellent results in 200 cases of amœbic dysentery from complete irrigation of the colon, every twelve hours, with a *solution of copper sulphate* (1 in 6000) at a temperature of from 106°–110°F. The patient was prepared for the instillations by receiving at 2 o'clock in the morning 1½ ounces (45.0 c.c.) of a saturated solution of Epsom salt by the mouth, and just before the copper solution was introduced, the bowel was thoroughly irrigated with sterile water.



# MEDICINE

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## Infectious Diseases

**TUBERCULOSIS.**—M. P. Ravenel<sup>1</sup> in a consideration of the etiology of tuberculosis gives a summary of the work of many careful investigators which shows the great importance of the alimentary tract as a portal of entrance for the tubercle bacillus. The tonsils are not infrequently found to contain tubercle bacilli and their importance as a portal of entry for pathogenic microorganisms has long been recognized. The conclusion is arrived at that the tubercle bacillus is able to pass through the intact mucous membrane of the alimentary tract without producing a lesion at the point of entrance, and this was found to take place most readily during the digestion of fats. The bacilli pass with the chyle through the lacteals and the thoracic duct into the blood, which conveys them to the lungs, where they are retained largely by the filtering action of the tissues. Milk from tuberculous cattle is a source of infection and it is probable that a considerable number of cases of tuberculosis originate in this way. Tuberculosis can be communicated by contact infection such as results from postmortem wounds, the cleaning of vessels used by tuberculous individuals, etc., but this mode of infection does not play a great part in the dissemination of tuberculosis. Alimentary infection is especially frequent in children.

S. A. Knopf strongly urges that *individuals dying of tuberculosis and similar infectious diseases be cremated*. Except the possibility of medicolegal complications the profession was in favor of cremation, as shown by the Knopf enquiry.

The recent literature on the *relation of human and bovine type of tubercle bacilli*<sup>2</sup> and the communicability of bovine tuberculosis to human beings proves the considerable danger of human infection from

tuberculous cattle. Schroeder and Cotton<sup>3</sup> from their investigation believe that a tuberculous cow is more dangerous to the health of man than is a human consumptive. (This is a very extreme view.) The recently issued report of the Royal British Commission on Human and Bovine Tuberculosis<sup>4</sup> states that there can be no doubt that some cases of tuberculosis, especially in children, are the result of infection with the bacillus of bovine tuberculosis, the bacilli being introduced through milk from tuberculous cattle.

*The ophthalmotuberculin test* was simultaneously proposed by Calmette<sup>5</sup> and Wolff-Eisner.<sup>6</sup> E. R. Baldwin<sup>7</sup> describes the method of performing the test and also gives the results obtained by him in a number of cases that were tested by the method. The test consists in the instillation of a drop of weak tuberculin solution into the eye. A conjunctival hyperæmia is produced in infected individuals due to the increased sensitiveness to tuberculin of the tissue of tuberculous as compared with non-tuberculous individuals. The ease with which vascular changes can be observed in the conjunctiva of the tested eye and compared with the condition of the opposite eye, is of great aid in determining the result of the instillation, and renders the method superior to the cutaneous tuberculin diagnostic reaction.

A filtered sterile saline solution of tuberculin is used. By clinical testing, a solution is prepared of such strength that one drop will give a reaction that is not too strong. Baldwin used a measured drop and advocates the use of two solutions, one strong and the other dilute. One drop of the weak solution is instilled into the eye and if no reaction occurs 48 hours later a drop of the stronger solution is instilled into the other eye. No constitutional reaction follows and no local harm to the eyes has been observed. The test is contraindicated in acute inflammatory affections of the eye, and should not be used in cases when the diagnosis can be made with certainty by microscopical or physical methods. The test is easier to perform and less annoying to the patient than the subcutaneous administration of tuberculin. Baldwin's very conservative statement as to the value of the test should be borne in mind, viz.: "The most one can say at present is that a prompt positive reaction to a small dose adds to a suspicion when symptoms of tuberculosis are present."

Olmer and Terras,<sup>8</sup> from a study of the reaction in 54 cases, conclude that the ophthalmic tuberculin test is more reliable than the cutaneous tuberculin reaction. (The test appears to be valuable but needs extensive investigation still.) The cutaneous tuberculin reaction as described by von Pirquet<sup>9</sup> is the local cutaneous reaction that occurs

in an infected individual when he is vaccinated with tuberculin by scarification. (The value of this test is very questionable as yet.) Engle and Bauer<sup>10</sup> found the cutaneous test gave rather variable results in nurslings and in older children.

**TYPHOID FEVER.**—W. H. Park<sup>11</sup> has investigated the possibility of *typhoid fever being transmitted by contaminated ice* that has been made from impure water. The conclusion is reached that the use of ice that has been made from polluted water is less dangerous than the use of unfrozen water. The danger of infection decreases with the length of time the ice has been stored. After four weeks in storage the ice is considered as safe as sand-filtered water, and at the end of six months the danger of infection is quite negligible. River water that is greatly contaminated by sewage should not be used for harvesting ice.

G. S. Soper<sup>12</sup> describes an outbreak of typhoid fever at Oyster Bay in which the infection seems to have been due to a cook who was a *chronic typhoid bacillus carrier*. In seven families where she had been employed outbreaks of typhoid fever had occurred (in all 26 cases with one death). Typhoid bacilli were isolated from the stools of the individuals and no other cause for the epidemic could be found. L. A. Nieter<sup>13</sup> urges that a more careful search be made for chronic bacillus carriers in institutions. Thirteen infected individuals were found in one German insane asylum and of 1,700 persons examined 3 per cent. were found to be infected. Dehler<sup>14</sup> has operated on two chronic typhoid bacillus carriers. The gall-bladder was opened and drained. Both cases are now free from typhoid bacilli.

C. F. Mason<sup>15</sup> remarks on the importance of *contact infection* as a mode of disseminating typhoid fever in the military service. Following the report of Reed, Vaughan and Shakespeare on the origin and spread of typhoid fever in the army during the Spanish-American war, the military authorities have guarded against contact infection in the camps and barracks. There has since been an almost continuous decrease in rate of deaths from typhoid fever in the military service. The soldiers have been taught the danger of contact infection.

M. Letulle<sup>16</sup> states that careful examination will usually show *ulceration of the soft palate* in cases of typhoid fever. The ulcers are round or oval, not covered with membrane or pus, and of a yellowish or pinkish gray color. The ulcers may appear before a positive Widal reaction is obtained and always occur before the fifteenth day of the disease. The ophthalmo-toxic reaction has been used by Chantemesse<sup>17</sup> in the early diagnosis of typhoid fever. The typhoid toxin is

precipitated from a culture by absolute alcohol, and an aqueous solution prepared. The test is performed in a manner analogous to the tuberculin ophthalmic test. (Its value has not yet been well determined.)

H. Hirschfeld<sup>18</sup> gives the results of his studies of the "*complement deviation*" as a means for the early diagnosis of typhoid fever. Positive results were obtained earlier than with the agglutination test. The test as at present performed is altogether too complicated to be used as a routine method of diagnosis.

Grimme<sup>19</sup> describes a case of typhoid fever that he believes developed through *autoinfection from the gall-bladder*. The attack closely resembled acute febrile jaundice (Weil's disease). The Widal test was positive and typhoid bacilli were cultured from the blood. The autopsy showed atrophy of Peyer's patches and evidences of a previous typhoid infection. The case is considered to be one of typhoid fever from autoinfection by bacilli in the gall-bladder. The writer suggests that a Widal test for typhoid fever be made in all cases of acute febrile jaundice.

H. Conradi<sup>20</sup> believes that *early contagion* is an important factor in the transmission of typhoid fever and other contagious diseases. Assuming that the period of incubation of typhoid fever is 10 days, in 600 cases of typhoid fever investigated, the contact infection must have occurred during the first week of the primary disease or even earlier. (Contact infection grows more important constantly and its prevention must always be held in mind.) Typhoid bacilli were found in the blood of an apparently healthy boy four days before he developed symptoms of typhoid fever.

Coleman and Buxton<sup>21</sup> from a study of the bacteriology of the blood in typhoid fever conclude that "typhoid bacilli are present in the blood throughout the course of every case of typhoid fever." The clinical picture of typhoid fever is that of an infection of the lymphopoietic organs by the typhoid bacillus with invasion of the blood stream and destruction there of many bacilli. The typhoid bacillus is probably always present in the blood before a positive Widal reaction occurs. Many laboratory workers report increasingly favorable results with blood cultures in the early diagnosis of typhoid fever. The advance has been due to the use of bile salt media and of larger quantities of blood in performing the test.

PNEUMONIA.—M. Fabyan<sup>22</sup> reports a remarkable *epidemic of croupous pneumonia* that occurred in a family of ten persons. Six members of the family developed pneumonia within a period of 10

days. A seventh member of the family had a suspicious acute febrile attack. Before the onset of the disease in one member of the family the father had been ill with an attack of cold, hoarseness, and abdominal pain. The two members of the family who escaped infection lived away from the house but returned to nurse the ill members of the family. In one case that terminated fatally pneumococci were cultured from the circulating blood during life and from the heart's blood at the autopsy. In the case where two members of the family slept together the second infection occurred from 6 to 9 days after the first. Crowding and poor ventilation were the only ascertained predisposing causes of the epidemic.

J. H. Musser<sup>23</sup> considers the frequency of empyema following pneumonia and classifies the signs that aid in its early recognition. In 12,892 cases of pneumonia collected from medical literature empyema occurred in 2.1 per cent. The frequency of empyema was slightly less in 489 cases of pneumonia that occurred in the University Hospital, Philadelphia. In a case of pneumonia the presence of a leucocytosis after the crisis, or a reappearance of the leucocytosis, is evidence of a reinfection, and if a serous pleurisy has been present it is probable that it has become purulent. The presence of a constant, not necessarily severe, pleuritic pain and deep-seated localized tenderness with the signs of a pleurisy along the division of the lobes or at the extreme base of the lung is highly significant of an empyema when accompanied by irregular fever.

**MENINGITIS.**—S. Flexner<sup>24</sup> has made a careful study of epidemic cerebrospinal meningitis. The biology of the *diplococcus intracellularis* was carefully studied. The brief vitality of the microorganisms when grown on artificial media is thought to be due to its disintegration by an enzyme. The strains of the *diplococcus intracellularis* vary much in virulence, and the virulence cannot be restored by passing the microorganisms through animals. Flexner was able to produce an acute inflammatory condition of the meninges in monkeys closely resembling the meningeal lesions that occur in human beings when infected with the *diplococcus intracellularis*. The inflammation descended from the meninges and involved the nasal mucosa; and this observation shows that the presence of meningococci in the nasal mucosa may be secondary to the meningeal infection. His efforts have been directed towards the production of a protective and curative serum. (His later work on the serum is highly encouraging.)

W. Kernig<sup>25</sup> gives the results of his observation of the sign that bears his name and was first described in 1884. In the examination of

thousands of cases suffering from other diseases "Kernig's sign" was usually absent. In 82 cases of epidemic cerebrospinal meningitis and in 80 cases of tuberculous meningitis the sign was present in 93.9 per cent. and 91.2 per cent. respectively of the cases. In diseases other than meningitis the appearance of the sign points to the involvement of the meninges, as was confirmed at autopsy in two cases of typhoid fever and one case of lumbar spondylitis observed by Kernig. In severe cases of meningitis the sign develops early. It disappears with the onset of paralysis and sometimes after lumbar puncture, but may reappear. The sign is less reliable in children than in adults. The conclusion is reached that the absence of the sign does not exclude meningitis. If the sign is present in an acute disease, meningitis or a meningeal involvement accompanied by some other disease is highly probable (but only "probable." Even this is too optimistic as to its value.).

**ERYSIPELAS.**—L. N. Boston and A. E. Blackburn<sup>26</sup> have made a statistical study of 564 cases of erysipelas that have occurred in the Philadelphia General Hospital during the past 5 years. The greatest number of cases developed during the early spring. The highest mortality was in children and in the aged. Renal complications are to be expected in erysipelas, but nephritis need not necessarily be a grave complication. Glycosuria was present in 6 cases. In over 85 per cent. of the cases the infection began on the face.

**MALARIA.**—R. Ross<sup>27</sup> gives a careful summary of the modern *prophylactic measures against malaria* in the English and American tropical colonies. Individual prophylactic measures are extremely difficult to enforce in semi-civilized countries and reliance must be placed largely on general sanitary measures. Such measures are most thoroughly carried out under the direction of the central government; the local authorities often lose interest in general prophylactic measures. Tropical sanitation against malaria and yellow fever should be directed principally towards efforts to exterminate the mosquito, and prophylaxis by the use of quinine and screens, as segregation can rarely be satisfactorily enforced. The dissemination of information as to the relation of the mosquito to the transmission of malaria tends to cause the educated inhabitants of the tropical countries to exercise a kind of "unconscious prophylaxis" against the disease. Notices, pamphlets, etc., are of very limited value as they reach only the educated inhabitants of the tropical countries. More active measures must be resorted to in order to bring about proper prophylaxis.

C. F. Craig<sup>28</sup> in an examination of over 1600 cases of malarial  
Vol. I. Ser. 18—15

infection found that in over 25 per cent. of the cases the plasmodia of malaria could be found in the blood, although the clinical symptoms were not severe enough to attract attention. The estivo-autumnal form of parasite was usually found. The finding is of considerable importance as these latent infections may be the source of infection of other persons, and soldiers returning from malarial regions may be a mode of the dissemination of malaria.

**SYPHILIS.**—The serum diagnosis of syphilis by means of the *hæmolytic complement deviation* test has attracted the attention of a number of laboratory investigators during the past year. P. Fleischmann and W. J. Butler<sup>20</sup> give a summary of the literature of the serum diagnosis of syphilis.

The technic of the method is complicated, and the test can be performed only by skilled laboratory workers, and in a well equipped laboratory. The method is of especial value for the determination of the etiological relation of syphilis to certain obscure affections, as nervous and mental diseases. The conclusion is reached that in the diagnosis of syphilis the complement deviation test is of unmistakable value. The question as to whether it can be determined by the test that a given case of syphilis can be cured, cannot be answered until further work has been performed. The hæmolytic complement deviation test is now used in the diagnosis of tuberculosis, syphilis and typhoid fever. (Its value is by no means determined as yet, and the testimony is still conflicting, though it seems favorable in syphilis especially.)

Rolleston<sup>20</sup> describes two cases of syphilis simulating typhoid fever; one case suffered from a low grade fever with marked cerebral symptoms and terminated fatally, the other case resembled typhoid fever but typical luetic manifestations proved the case to be of a syphilitic nature. The first case was thought to be diphtheria, later brain disease, and finally, typhoid fever. There was intermittent fever, enlargement of the liver and marked cerebral symptoms.

Parkes Weber<sup>21</sup> reports several cases and discusses the visceral and other changes connected with tertiary syphilitic fever. The fever is usually hectic in type, and may be accompanied by any one of the following symptoms: diarrhoea, severe gastro-intestinal symptoms, hepatic pain, tenderness and even jaundice. Some cases of so-called simple continued fever may possibly be of syphilitic origin.

**BUBONIC PLAGUE.**—The continued presence of *bubonic plague* in the western part of the United States has led to much study and investigation of this subject during the past year. From May to

November inclusive 109 verified cases of plague are known to have occurred and 66 deaths resulted.<sup>33</sup> The number of cases is decreasing, but plague foci are now found over a wide territory. Recent investigations have confirmed<sup>33</sup> the statement that rats are readily infected with the plague. Of, perhaps, greater importance, is the fact that the human flea and the rat flea frequently contain plague bacilli, and they are capable of transmitting it from rat to rat and very probably from rat to man.<sup>34</sup> The ground squirrel has also been found to be a host for the plague bacillus. Thorough disinfection or destruction of infected houses and extermination of rodents, fleas and other vermin are among the most important prophylactic measures. The tendency for cases to recur after a considerable length of time in previously infected foci shows the great difficulty of dealing with the problem.

R. P. Strong<sup>35</sup> concludes that it is demonstrated that a satisfactory immunity against the plague bacillus can be produced in the guinea-pig. The immunization is brought about by inoculation with living cultures of attenuated plague bacilli. He considers that this method of vaccination is the most efficient measure for the control of the disease.

**DENGUE FEVER.**—J. Goldberger and G. W. McCoy<sup>36</sup> give a description of dengue fever as seen in the Brownsville epidemic. The first case occurred in Brownsville about June 20th, and it is estimated that by August 15th, 8,000 of the 10,000 inhabitants of the town had suffered from the disease. The diagnosis of the cases in the presence of an epidemic is not difficult. The severe cases must be differentiated from yellow fever. The important differential points are the presence of the rash, which usually appears from the third to the sixth day of the disease, *i. e.*, either during the fever, at the termination of the remission on the third day, or at the termination of the fever. Albuminuria and jaundice are absent. The absence of catarrhal symptoms and the character of the rash differentiate the disease from influenza and measles. The cases resembled those of dengue seen in the Philippine Islands.

Asburn and Craig<sup>37</sup> have investigated the etiology of dengue fever in the Philippine Islands. Many cases were treated in the general wards of the hospital, but other patients did not contract the disease. The infected patients ate with the other patients but protection from mosquitoes was rigidly enforced. They were unable to transmit the disease through infected fomites. No organism could be demonstrated in fresh or stained specimens of the blood. Dengue is characterized by a leucopenia with a marked relative increase in the



small lymphocytes. Inoculations with filtered and unfiltered infected blood intravenously into healthy men produces a typical attack of the disease. The disease can be transmitted by the *Culex fatigans*. The period of incubation in infected cases was 3 days and 14 hours. Blood cultures were negative and the cause of the disease is considered to be ultramicroscopic. The only prophylactic measure necessary is protection against the bite of the mosquito.

**MALTA FEVER.**—The report of the British Commission for the *investigation of Mediterranean Fever*<sup>38</sup> states that the micrococcus melitensis is the cause of the disease. Contaminated goat's milk is considered the common means of disseminating the disease. Bacteriological examinations demonstrated that a large percentage of the Malta goats are infected with the disease. The milk and urine of goats and of human beings infected with the disease contains the micrococcus melitensis. Contact infection may play some part in disseminating the disease, but the principal source of danger is infected goat's milk.

**DYSENTERY.**—J. W. Fisher<sup>39</sup> has made a study of normal and diarrhoeal stools for the detection of dysentery or allied organisms. In 37 cases of asylum dysentery in which the stools contained blood or bloody mucus the Flexner type of dysentery bacillus was found. In 44 per cent. of a number of normal stools a dysentery-like organism was found.

Kruse<sup>40</sup> in some new researches on dysentery reaches the conclusion that toxins can produce diphtheritic and catarrhal conditions of the large intestine. The ordinary saprophytic bacteria may become virulent under the influence of the condition produced by toxins and cause autointoxication. The possibility of the germs that have become virulent infecting other individuals and producing typical attacks of dysentery is considered highly probable.

J. R. McDill<sup>41</sup> reports on the occurrence of abscess of the liver as a complication of intestinal amebiasis in the Philippine Islands. The most important method of preventing the formation of an hepatic abscess is the careful treatment of the primary intestinal infection. Solitary abscesses which are sometimes formed by confluence of smaller abscesses are the only form amenable to surgical treatment. In 90 per cent. of such cases early surgical intervention should result in cure.

**SLEEPING SICKNESS.**—Koch<sup>42</sup> in his final report on sleeping sickness deals largely with the use of atoxyl as a curative measure in the disease. An important fact in the prophylaxis against the disease is that the *Glossina palpalis* in order to exist must be supplied with

the blood of a vertebrate animal; the animal most frequently furnishing the blood is the crocodile. The breeding place of crocodiles is easily found and their destruction deprives the glossina of the necessary vertebrate blood.

#### Diseases of the Respiratory System

PLEURISY.—F. P. Fraley<sup>48</sup> has made a critical summary of the clinical records of 500 cases of *pleurisy* occurring at the Pennsylvania Hospital. Bronchitis and exposure to cold and dampness seem to be more frequent exciting causes of pleurisy than tuberculosis or rheumatism. (Tuberculosis is really the most common cause.) The colored race is especially susceptible to pleurisy. The examination of the blood, cyto-diagnosis, and inoscopy are not of great value as aids in the diagnosis of pleurisy. Aspiration seems to shorten the course of the disease and usually does not have to be repeated in order to effect a cure. Empyema most frequently follows croupous pneumonia and is usually fatal unless treated by surgical intervention.

W. J. Calvert<sup>44</sup> has made an anatomical study of the posterior median pleural boundary with reference to *Grocco's sign*. The right pleural border passes in front of the vertebral column for a varying distance, often to, and in some cases beyond, the median line. The left pleura does not extend on the vertebral column as far as the right pleura. G. Padoa<sup>45</sup> of Grocco's clinic reviews the literature confirming the diagnostic value of Grocco's triangular area of dulness in pleurisy with effusion. (Grocco's sign was described in the *INTERNATIONAL CLINICS*, vol. i, Series 17, 1907.) The triangular area of dulness on the side of the vertebræ opposite to a pleural effusion is largely due to the displacement of the organs by the pleural effusion. The triangular area of dulness has been found by him in all but two cases of pleural effusion, in the two negative cases the history suggested old pleural adhesions. The sign was present in two cases of pneumonia with pleural effusion. (The continued favorable clinical reports indicate that the sign is of some diagnostic value, though not important.)

#### Diseases of the Gastro-Intestinal Tract

GASTROSUCCORRHŒA.—The excessive secretion of gastric juice during the process of digestion, "*digestive gastrosuccorrhœa*," must be distinguished from the continuous excessive secretion of gastric juice, frequently called Reichmann's disease and also from intermittent hypersecretion which accompanies certain nervous conditions.

Boas<sup>46</sup> has observed 12 cases of digestive hypersecretion and H.

Strauss <sup>47</sup> during the past 12 years has studied over 100 cases of the affection. The subjective symptoms resemble those of hyperacidity, chronic nervous dyspepsia or atony of the stomach, and Boas is of the opinion that this close clinical resemblance has led to many errors in diagnosis. In the cases described by Boas the most prominent symptoms were the rapid loss of flesh, and obstinate constipation. The diagnosis is made by an examination of the contents of the fasting stomach and comparing the amount of fluid obtained with the quantity of stomach contents obtained after a test breakfast without fluids, and again after an ordinary test meal. An unusually large proportion of fluid to the solid contents indicates digestive gastrosuccor-rhea. The gastric splashing sound is frequently elicited and care must be taken to avoid mistaking the condition for motor insufficiency or stagnation with retention. Strauss states that visceral ptosis frequently accompanies the condition. Digestive gastrosuccor-rhea is amenable to proper treatment.

L. A. Conner <sup>48</sup> reports two cases of *acute dilatation of the stomach* and has collected 82 cases from medical literature. The condition most frequently develops after operations with general anæsthesia. Dilatation of the duodenum, and some form of duodenal obstruction seem to play some part in its production. The common cause of duodenal obstruction is constriction of the lower end of the duodenum from stretching of the mesentery through traction exerted by the small intestine hanging over the pelvic brim. The mesenteric constriction is favored by any condition which permits of the small intestine entering into the pelvis: collapsed gut, long mesentery, and dorsal decubitus, etc. The mortality in the reported cases is 72 per cent., but the prognosis is more favorable under early treatment. Braun and Seidel <sup>49</sup> consider the condition as due to acute insufficiency of the stomach, usually from disturbances of innervation which are especially apt to occur after anæsthesia and surgical operations. If due to dietetic errors and decomposition of food the stomach should be emptied at once.

A. B. Cecil <sup>50</sup> summarizes the cases of phlegmonous gastritis that have been reported since 1896. In a case reported by him an immense number of cocci were found in sections of the stomach wall. The diplococcus was lanceolate in shape and occurred both within and outside of the leucocytes. Colon bacilli were present, but were regarded as due to secondary invasion.

C. A. Herter <sup>51</sup> in an interesting monograph discusses the interesting subject of the relation of bacterial processes in the intestinal

tract in some cases of advanced anæmia and especially the relation of chronic infection of the intestinal tract with the bacillus *ærogenes capsulatus*, and other anærobic bacteria. The infection of the intestinal tract may become chronic lasting through the life of the individual and it cannot be said that such infection may not exert some detrimental influence on the duration of life, and be an etiological factor in causing the condition of premature senility and the phenomena of old age.

INTESTINAL PUTREFACTION.—C. A. Herter<sup>52</sup> has made some interesting observations on the influence of food and of epithelial atrophy on the *manifestations of saccharobutyric intestinal putrefaction*. Attention is directed to the pernicious effect of epithelial atrophy in intestinal putrefaction. The secretion of succus entericus is impaired, the production of erepsin is diminished, and there is a diminished secretion of secretin with a resulting diminished pancreatic activity. The intestinal epithelial atrophy interferes with the excretion of fluids from the blood into the intestines and thus explains the failure of saline purgatives to act in long standing cases of intestinal inflammation. The epithelial atrophy diminishes the capacity of the epithelial cells for decomposing certain cleavage products of digestion, and interferes with the synthesis of fatty acids and glycerin into fats. The power of binding certain toxic bodies formed in the intestines is impaired. This lessened ability to take care of toxic bodies may perhaps facilitate damage to the red blood cells that collect in congested areas of the intestinal tract in certain anærobic infections. In applying the conclusions derived from the study to the practical management of cases of intestinal putrefaction the cases should be divided into three groups: (1) Well defined cases of saccharo-butyric putrefaction. (2) Long standing cases. (3) Extreme cases.

#### Diseases of the Pancreas and Liver

A. Egdahl<sup>53</sup> reports two cases of acute pancreatitis and summarizes the important etiological factors in 105 additional cases collected from medical literature. The onset in the cases was usually sudden. Gallstones were an associated condition in 42 per cent. of the cases and cholelithiasis is considered to be the most important etiological factor. Among the other etiological factors are typhoid fever, tuberculosis, syphilis, gastric ulcer, traumatism, etc. The organisms most frequently found are the colon bacillus, streptococcus and staphylococcus. The pain is explained by the stretching of the parietal peritoneum. The marked collapse is thought to be due to the trypsin that is absorbed.

Fat necrosis was usually found at operation. Of the 105 cases, 59 died; the mortality was highest in the cases of pancreatitis complicated by gallstones. It is of interest to note that the three conditions found associated with pancreatitis, *viz.*, gallstones, digestive disturbances and typhoid fever, are very common conditions and many persons that have not had acute pancreatitis suffer from these diseases.

Dieulafoy<sup>54</sup> accepts the conclusion that gallstones predispose to acute and chronic pancreatitis. The pancreatitis is brought about by the thickening and narrowing of the common and pancreatic ducts with a resulting cirrhosis or gangrenous condition of the pancreas. He calls attention to the fact that the so-called "pancreatic drama," vomiting, pain, abdominal rigidity, collapse and a tendency to jaundice has been observed in only one case of carcinoma of the pancreas and in this case gallstones were an associated condition. The pancreatic drama serves to differentiate acute pancreatitis from carcinoma of the pancreas and from pancreatic calculi.

H. U. Williams and F. C. Busch<sup>55</sup> conclude from their experimental work that acute pancreatitis may result from the passing of the contents of the duodenum into the pancreas through the diverticulum of Vater. The previous passage of biliary calculi dilates the common duct and predisposes to the passage of the duodenal contents into the pancreas.

C. H. Whipple<sup>56</sup> has studied the relation of faecal necrosis to pancreatitis in 281 cases in acute intoxications in acute diffuse pancreatitis and in many cases of fat necrosis and hæmorrhagic pancreatitis. A moderate degree of cirrhosis not involving the islands of Langerhans is a common finding at autopsies.

Osler<sup>57</sup> divides cases of acute pancreatitis into cases with enlargement of the glands, and cases with suppuration or necrosis. The mortality is less than 50 per cent. in operative cases and 90 per cent. of the cases not operated upon die.

J. D. Steele<sup>58</sup> describes the method of determining the total amount of the faecal bacteria by weight as advised by Strasburger<sup>59</sup> and its clinical significance. The determination of the proportion of bacteria by plating and enumerating the colonies is considered inaccurate because of the lack of homogeneity of the faeces, and the presence of many dead bacteria. The diet is considered the most important factor in determining the amount of bacterial growth in the intestines. The number of bacteria varies inversely with the difficulty of digestion and amount of residue of various foodstuffs. The bacteria were increased in cases of achylia with diarrhoea, hyperacidity with diarrhoea, chronic

cholecystitis, poor starch digestion and gumma of the pancreas. The number was found to be decreased in jaundice, and chronic atonic constipation. The number was increased by various so-called intestinal antiseptics but in healthy persons there was a decrease following the administration of bismuth salicylate and betanaphthol.

A number of writers have studied the comparative value of the various methods of examination of the fæces and gastric contents for *occult blood*. E. H. Goodman<sup>60</sup> recommends the benzidin test as a routine clinical laboratory method. K. Schroeder<sup>61</sup> suggests that various dilutions of the fæces and of the test reagents be tried in each case. The reaction was found to be most marked when a certain proportion of blood and the guaiac solution were mixed. Large amounts of blood when used with great concentration of the guaiac hinder the reaction.

M. Einhorn<sup>62</sup> suggests the use of paper that has been sensitized with benzidin as a rapid test for occult blood.

O. T. Williams<sup>63</sup> concludes that in certain intestinal conditions abnormal fat assimilation leads to the formation of *calcium soaps* and other insoluble compounds of the fatty acids. These insoluble compounds are the bases for the formation of true intestinal sand, appendiceal concretions, and other fæcal masses simulating true calculi. The abnormal fat assimilation may have some relation to certain forms of intestinal colic and mucous colitis.

T. B. Barringer, Jr.,<sup>64</sup> and J. C. Roper discuss the prognosis of transient spontaneous glycosuria and its relation to *alimentary glycosuria*. The twenty cases that had been studied were classed as follows five years later: diabetes mellitus 20 per cent, suspicious of diabetes mellitus 15 per cent., somewhat suspicious 55 per cent. Eight of ten cases of spontaneous glycosuria in which sugar recurred became diabetic or probably diabetic. The possibility of patients with glycosuria developing severe diabetes mellitus is of special importance to examiners for life insurance.

W. G. MacCallum<sup>65</sup> reports two cases of *diabetes mellitus* in children and a careful study of the histological changes in the pancreas. The islands of Langerhans are apparently increased in size and number. Hypotheses are offered attempting to explain the relation of the hypertrophy of the islands of Langerhans and diabetes mellitus.

GALL-STONES.—Ehret<sup>66</sup> calls attention to some important signs of stones in the common bile duct as observed in seventeen cases. The symptom complex consists of recurring fever and jaundice without spontaneous pain over the hepatic region. The temperature was gen-

erally normal, but after intervals of four to twelve weeks the temperature may rise as high as 105°F. and persist high for one to three days and then drop suddenly to normal. These rises in temperature are accompanied by an exacerbation of the existing icterus, or its appearance if not already present. The icterus develops rapidly but declines gradually. The liver is generally tender on pressure but there is no spontaneous pain in the hepatic region. "The occurrence of the above symptoms may be accepted as positive evidence of a stone in the common bile duct, although their absence does not necessarily exclude such a contingency. The symptoms are the expressions of exacerbations of cholangitis, and stones in the common bile duct are peculiarly likely to promote such a process.

M. H. Richardson<sup>67</sup> in an article bearing the title "Gall-stones Without Symptoms and Symptoms Without Gall-stones," comments upon the large number of biliary cases in which errors of diagnosis are made. A case may present the so-called classical symptoms of biliary calculi but at operation no gall-stones are found. The finding of gall-stones in cases that do not suffer from symptoms of biliary calculi is equally frequent. The error is explained by the fact that gall-stones are only at times a cause of certain abnormal changes in the gall-bladder, similar pathological changes being produced by other causes than gall-stones. Gall-stones may cause serious anatomical changes and yet the subjective symptoms may be very mild.

JAUNDICE.—Arnsperger<sup>68</sup> describes the following points that will aid in differentiating the three frequently confused *causes of jaundice*. In obstruction of the common duct by gall-stones the jaundice appears suddenly with an attack of pain and the patient appears very ill, often in a septic condition. Cholangitis results and in chronic cases there is a cirrhosis of the liver, the right lobe first enlarging. The gall-bladder is not palpable. The urine contains no urobilin but much bilirubin. In cases of occlusion of the common duct by malignant growth the jaundice and cachexia gradually appear. The liver is enlarged, the gall-bladder is palpable and ascites is present. The stools are clay colored and there is secondary anæmia with a tendency to hæmorrhage. In parenchymatous affections the jaundice gradually develops without colic and may show remissions lasting over a long period. The gall-bladder is not palpable but the liver and spleen are enlarged. The urine contains urobilin but no bilirubin. The stools are unchanged and the anæmia may be severe.

F. Widal, P. Abrami and Brule<sup>69</sup> describe a method of differentiating hæmolytic jaundice from other forms of jaundice. The cases

studied were a case of Hayem's jaundice with splenomegaly, another of severe jaundice and anaemia from septicæmia and two cases of congenital jaundice. In the differential test the deplasmatised red blood corpuscles were tested with hypotonic solutions of sodium chloride. In all of the cases of hæmolytic jaundice the resisting power of the red blood corpuscles was greatly reduced. The corpuscles easily underwent fragmentation. (The term hæmolytic jaundice cannot be correctly used to indicate the extra-hepatic production of bile.)

#### Metabolic and Renal Diseases

**DIABETES INSIPIDUS.**—Seiler<sup>70</sup> has made a careful study of the metabolism in several cases of *diabetes insipidus*, and confirms the view that the ingestion of large quantities of nitrogenous food is not followed by a rise in the specific gravity of the urine, in cases of diabetes insipidus. The kidneys seem to be unable to excrete urine containing as large a proportion of solids as occur in normal urine. Therefore, in this condition the total quantity of solids can only be excreted by greatly diluting the urine. The desire for water for the dilution of the urine gives rise to the sensation of thirst. No explanation is advanced as to why the kidneys are unable to excrete a normally concentrated urine. In interstitial nephritis the polyuria may be of a similar compensatory nature enabling the body to eliminate waste products satisfactorily.

#### Diseases of the Cardio-Vascular System

Schott<sup>71</sup> in an article on "*acute overstraining of the heart*" describes the results of some experiments he carried out on healthy normal subjects. After wrestling if these subjects did not show dyspnoea, the only changes noted were increase of rate in respiration and pulse, but if dyspnoea were present the heart outline was moved outward 1 cm. or more, the apex was shifted visably toward the axilla, the respiration was doubled, blood pressure fell very decidedly and arrhythmia was present.

Hooke and Mende<sup>72</sup> report unfavorably on Katsenstein's test while Feliner and Rudinger<sup>73</sup> say that this test reveals functional incompetency when other tests fail.

In a preliminary report Cabot and Bruce<sup>74</sup> discuss methods of estimating the functional power of the cardio-vascular apparatus. They take up in order the effects of changed position, Hertz's test, Levy's (Katsenstein's) test and Graüpnér's test. They have had little experience with the first three, but they were enabled to investigate the last test in seventy-five experiments. Graüpnér's test depends



upon the fact that normally after the pulse rate has risen and again fallen to normal as the result of exercise, the systolic pressure begins to rise, reaches its maximum some minutes later than the pulse rate, and gradually falls thereafter to, or sometimes below, the normal. In slightly weakened hearts this phenomenon still takes place but the rise in pressure is delayed and diminished in degree; while in seriously weakened hearts there is no rise but a fall of pressure from the start and then a gradual ascent to the normal. They were enabled to verify Graüper's findings both as to normal and weakened hearts. In some of the cases, believed by them from ordinary methods of examination to be normal, there was considerable variation from the ordinary curve of the blood pressure after exertion. While on the other hand, various cases of valvular disease with good compensation showed a normal curve.

Stern <sup>75</sup> advises as an additional method in cardiac diagnosis the raising of the patient's pelvis while the heart is being examined.

Rautenberg <sup>76</sup> holds that a see-saw movement of the right wall of the thorax is pathognomonic of tricuspid insufficiency. This sign is present early even when the insufficiency is of slight degree. He cites a number of cases in support of his position.

Rogers <sup>77</sup> calls attention to interauricular insufficiency where apparently there is no connection between the auricles. Careful study at autopsy will reveal the fact that water can be transmitted from the right to the left auricle but no transmission takes place in the reverse direction. Intense cyanosis and dyspnoea on slight exertion are the chief symptoms. He reports two cases associated with bronchitis and emphysema. Post mortem examination confirmed the diagnosis in one of these cases.

Mann <sup>78</sup> reports a case of anomaly of the heart in a patient 35 years of age. The ordinary signs of heart disease were present, increase of cardiac dulness, diffuse apex beat and a rushing systolic murmur replacing the first sound of the heart and heard over the entire precordia. The heart sounds were tumultuous and irregular, and there was pulsation in the veins of the neck. Intense dyspnoea and cyanosis were present with general oedema and effusion into the serous sacs. Autopsy revealed the fact that there was but one ventricle. The aorta, pulmonary artery, mitral and tricuspid orifices were in their normal positions. The auricles were normal except for the presence of a patent foramen ovale. The man's final illness was his first and he had not been cyanosed until the last three weeks of his life.

Voorsanger <sup>79</sup> reports a case of aneurysm of the left ventricle in

which the cavity was situated about 8 cm. from the apex just under the chordæ tendinæ. The valves with the exception of a thickened mitral were normal.

Blumgart<sup>80</sup> describes a tumor of the mitral valve occurring in a woman of 86 years. There was no clinical history. The structure of the growth resembled that of a fibromyxoma but the lack of capsule on its ventricular surface, together with the aneurismatic bulgings on the rest of the cusps, inclined the author to the view that it was not a new growth but an organized thrombus in an aneurism of the valve in which the capsule around the thrombus was nothing but the dilated cusp.

Schnoeppler<sup>81</sup> reviews the literature of primary cardiac tumors analyzing 61 cases, and reports a case of primary sarcomatosis of the epicardium.

Schwarz<sup>82</sup> reports a case of free pulmonary hæmorrhage in mitral stenosis and extensive sclerosis of the pulmonary arteries occurring in a man of 30. Attention is called to the fact that the hæmorrhage had its origin in the marked congestion due to the stenosis of the mitral valve. The vessels showed no breaks but rather the process of endarteritis proliferans, so the hæmorrhage must be ascribed to congestion alone.

Kerr<sup>83</sup> in a paper on the intensity of the pulmonic sound in mitral incompetence calls attention to the fact that pulmonic pressure is increased in mitral insufficiency as well as in mitral stenosis. He asks why hæmoptysis is so much more frequent in the latter condition. He answers this question by reasoning that the pressure is greatest in both lesions during ventricular systole, but in insufficiency the pressure falls immediately on the completion of the systole during the period of relaxation that takes place before the semilunar valves close, while in stenosis the increased pressure persists well into diastole, hence the signs of high blood pressure in the pulmonary circulation are more marked in the latter condition.

Galli<sup>84</sup> refers to a family he observed in Rome in which the father died of heart disease at 45 years of age, and the four children show signs of myocardial disease. He applies to this condition the term, "inherited myocardium." He refers to Huchard's "inherited aortism;" and to "inherited endocardium," which condition may involve the valves.

Babcock<sup>85</sup> divides cases of myocardial degeneration, clinically, into two groups. (1) Those in which the diagnosis is comparatively easy and is based on good and sufficient data, and (2) those in which the

diagnosis is made more by inference or exclusion, the data in such cases being few but often significant. In summing up under the first class he considers a diagnosis of chronic myocarditis justifiable if a patient past middle age develops symptoms of cardiac incompetency and at the same time shows sclerosis of the arteries or dilatation with hypertrophy of the heart. The presence of angina pectoris or of cardiac asthma leaves no room for doubt. If chronic nephritis with high tension exists it is difficult to decide whether the cardiac inadequacy is due more to the hypertension or to the state of the heart muscle. He refers to border line cases seen in persons approaching middle age in which the diagnosis is so difficult that the question of degeneration had better be left "sub judice." Cases of the second class sorely test the skill and judgment of the physician. Here he contends that much depends upon the accurate determination of the deep cardiac dulness which should not reach more than nine or ten cm. to the left of the median line at the level of the fourth rib regardless of its relation to the mammillary line. Study of the second aortic sound is important. If this is loud and ringing and there is hypertension of more than 150 mm. mercury, hypertension may be assumed and hypertrophy after middle age means degeneration. Auscultation is more valuable after exercise. Under these circumstances one will often detect a faint, soft systolic blow at the apex which accompanies but does not replace the first sound. This is the murmur of muscular mitral insufficiency and whatever its mode of production it denotes inability on the part of the ventricular wall to cope with the strain to which it is being subjected. If the individual is past 40 years of age and displays marked hypertension, especially if this is associated with an impressively corpulent abdomen, the inference is justifiable that the myocardium is being over-taxed.

Cushny and Edmunds<sup>88</sup> summarize their observations on a case of paroxysmal irregularity of the heart along with experiments carried out on dogs as follows: "A case of paroxysmal arrhythmia with marked acceleration of the heart is described, and it is shown that the irregularity is due to irregular discharge of impulses and not to defects in the contraction of the ventricle which appears to respond to the impulses received. A similar form of irregularity in the dog's heart is described, and it is shown that this is due to the ventricles receiving irregular stimuli from the auricle which is in a state of fibrillation. This form of arrhythmia is shown to occur in dogs occasionally from peripheral irritation and it is probable that this gives rise to reflex inhibition of the vagus center, which acting on an

abnormal heart, causes auricular fibrillation. The suggestion is made that in the patient described and in other cases of paroxysmal arrhythmia the condition is due to auricular fibrillation from inhibition of the vagus center.

Hornung<sup>87</sup> reports four cases of peculiar paroxysms of tachycardia in which the patients showed distinct arteriosclerosis. He believes the condition results from a recurring transient disturbance like intermittent claudication.

Clark<sup>88</sup> calls attention to the occurrence of certain nervous conditions in both bradycardia and tachycardia, and particularly to the occurrence of severe epileptiform convulsions and loss of consciousness. These are not epileptic and are sometimes seen in both conditions. Referring to recent discoveries regarding the bundle of His in connection with heart block, he suggests that tachycardia may be a neurosis characterized by a great increase in the number of auricular contractions. These in turn bring about fatigue in the bundle of His, and lessen its conductivity, as a consequence impulses are lost, ventricular contraction is disturbed, and delayed, and cerebral anæmia results with the above named nervous disturbances. This condition being merely a functional derangement of the bundle of His, the prognosis in tachycardia is not bad. In bradycardia, on the other hand, the bundle of His suffers from severe structural changes, which are never recovered from.

Joachim<sup>89</sup> reports a case of disassociation of the auricle and ventricle rhythms in which the diagnosis was confirmed by registering the auricular beats through the œsophagus. He says, "this method is tedious and disagreeable to the patient."

Vaquez<sup>90</sup> and Esmein report a case of heart block due to a gumma involving the bundle of His.

Butler<sup>91</sup> speaks of a case of Adams-Stokes' disease in which the autopsy revealed fatty degeneration of the bundle of His to such an extent that the bundle had atrophied to one-fifth of its normal size.

Fahr's<sup>92</sup> article tends to confirm the assumption in regard to the myogenic theory of the heart action and that the muscular elements are responsible for the coördinated contractions of the auricles and ventricles.

Pierson<sup>93</sup> concludes that a lesion in the bundle of His is capable of producing heart block, but he believes that the conduction of the cardiac impulse is through the nerve element and not through the muscle. He attributes heart block to lesions which may exist at different levels of the nervous system. The causes are essentially nervous.

House <sup>94</sup> reviews the history, etiology, pathology, and symptoms of Adams-Stokes' disease and describes a case which showed considerable improvement after two years. He ends his discussion with the statement that "one is justified in regarding Adams-Stokes' disease as the result of a lesion of the tenth nerve causing bradycardia with secondary or accompanying symptoms depending upon the location of the lesion in the course of the nerve." (Not in accord with present knowledge.)

Louis <sup>95</sup> reviews a number of cases in which the bigeminal pulse was observed. He claims there is apparently only one constant relationship with this form of pulse and that is a greatly dilated and hypertrophied left ventricle. There are two types, one associated with arteriosclerosis, and the other not.

Calvert <sup>96</sup> summarizes his article on the pulsus paradoxus in pericarditis with effusion as follows: "(1) Pericardial effusion produces stenosis of the venæ cavæ. (2) This stenosis is relatively compensated by a rise in venous pressure. (3) This compensation fails when the pericardial pressure is greater than the venous pressure. (4) Owing to respiratory changes in the venous pressure the degree of broken compensation varies in inspiration and expiration—greatest in inspiration and least in expiration. (5) The variation in compensation carries varying quantities to the right heart (and the general circulation)—least in inspiration, greatest in expiration. (6) The respiratory variation in quantity of blood passing to the general circulation is sufficient to explain the pulsus paradoxus."

#### Diseases of the Blood Vessels

Ritook <sup>97</sup> reviews seventeen cases whose symptoms he explains by assuming a defective development of the arterial system. He refers to fifty-six cases of hypoplasia of the arterial tree which he found in the literature. He speaks of its association with youth, all the cases being under twenty-seven years of age. Extreme anæmia, defective development of the other organs, early fatigue, subnormal temperature, and cardiac signs occur in the condition.

Bickhardt <sup>98</sup> and Schueman describe a case of aneurysm of the hepatic artery. The first symptoms of this condition are due to frequent hæmorrhage into the biliary passages accompanied by pain, jaundice and hæmorrhage from the digestive tract. There is a second group of symptoms which results from mechanical conditions, spasmodic pain and a palpable and possibly a pulsating tumor in the liver with a systolic murmur. Thirty-seven cases of this character have been reported in the literature.

Cary<sup>99</sup> reports a case of varicose aneurysm of the aorta and vena cava. Death resulted from rupture of the aorta into the vena cava.

Osler<sup>100</sup> reports a case of telangiectasis circumscripta universalis. The face shows a few spots similar to acne rosacea. The neck is free. The skin of the trunk and extremities, especially that of the chest and back, the flexor surfaces of the forearms and inner aspects of the arms, show numerous dark red, purpuric like spots which often coalesce into quite large blotches. The spots change to a bright red on rubbing and disappear with pressure leaving a brownish stain. There is no elevation above the surrounding skin and no individual blood vessels can be made out. Fictitious urticaria can be produced. The fingers present the appearance of Raynaud's disease and are cyanotic. The lesions were evidently due to capillary dilatation. The skin lesions were associated with recurrent colic, probably due to gastrointestinal urticaria, and hæmaturia, which symptom is common in the hereditary form of the disease. This case was evidently acquired and not congenital.

McCrae<sup>101</sup> describes aneurysm of the aorta which had encroached upon the upper lobe of the left lung forming a cavity whose walls were composed principally of lung tissue. The symptoms led to a diagnosis of tuberculosis of the lungs, but no tubercle bacilli were found. Autopsy showed the condition to be due to a syphilitic aortitis.

Loeb and Fleisher<sup>102</sup> report a series of experiments carried out to determine the influence of iodine preparations on the vascular lesions produced by adrenalin. Their conclusions are:

"(1) It is not possible by the use of various iodine preparations to prevent the arterial changes produced in rabbits by the injection of adrenalin. No beneficial effect of the iodine preparations was noted in our experiments.

"(2) When large doses of iodine preparations were injected, the arterial changes produced by adrenalin were more marked than when adrenalin was used alone. Our experiments suggest that iodipin acts less strongly in this direction than does potassium iodide.

"(3) Injections of potassium sulphocyanide in either fair sized or relatively large doses did not cause an increase in the arterial lesions produced by adrenalin. Our experiments point rather to the possibility that potassium sulphocyanide exerts a preventive influence on the action of adrenalin in producing arterial lesions; we cannot state this fact with any degree of positiveness, for in view of the uncertainty and variability of the action of adrenalin our experiments are hardly sufficiently extended to draw a positive conclusion.

"(4) Iodipin has no advantage over bromipin in preventing the vascular lesions of adrenalin, and in none of these series (combination of adrenalin and iodipin or bromopin) do we find the lesions less marked than when adrenalin was used alone."

Miles and Johnstone<sup>103</sup> found that after injection of various doses of adrenalin into 61 apparently healthy rabbits only 17 or 27.86 per cent. showed arterial lesions; while out of 58 apparently normal rabbits, obtained to a great extent from the same sources and kept under the same conditions, 20 or 34.48 per cent. showed distinct arterial lesions. With these findings as a basis they question all of the recent work on experimental adrenalin arteriosclerosis in rabbits and suggest that careful controls should be carried out in future experiments on this subject. (The observations of others on the same point show clearly that adrenalin produces atheromatous changes.)

The deductions Elliott<sup>104</sup> reaches from clinical observation on blood pressure and Bright's disease are as follows: (1) The ordinary clinical type of arteriosclerosis is not necessarily accompanied by high blood pressure, a large per cent. failing to show this development. (2) When high blood pressure is associated with the arteriosclerosis it points to the existence either of associated renal disease or sclerosis of the splanchnic vessels or of the aorta above the diaphragm (one or both). (3) If we are able to exclude chronic interstitial nephritis in such a case splanchnic or aortic sclerosis is to be suspected.

Marple<sup>105</sup> says, "The ocular lesions of arteriosclerosis may consist of a general change in the size of the arteries and veins of the eye-grounds, in the color of the arteries and in the calibre of the vessels.

Huchard<sup>106</sup> refers to a state of pre-sclerosis the result of some intoxication which is characterized by arterial hypertension. If this condition is not combatted in time it leads to the development of arteriosclerosis. He has often noted that patients who had first showed the signs of pre-sclerosis sooner or later develop all the cardio-vascular and toxic phenomena of cardio-renal arteriosclerosis. He insists that we recognize two stages of arteriosclerosis, curable and incurable.

Janeway<sup>107</sup> discusses the pathological physiology of chronic arterial hypertension and its treatment. He says it is common in nephritis, occurs occasionally in arteriosclerosis and constitutes the chief feature, during life, of a clinical group of cases which present the same cardio-vascular lesions as chronic Bright's disease without evidence of renal involvement. This latter variety he prefers to call "hypertension of unknown origin." In considering the physiological mechanism he believes that in the small number of patients in whom arterio-

sclerosis leads to persistent hypertension, the latter must be a physiological necessity for the maintenance of an adequate abdominal circulation. He inclines to Loeb's explanation of hypertension in nephritis, namely, that high arterial pressure occurs in those cases where the glomeruli are extensively diseased. The functional activity of the kidney is dependent upon the quantity of blood flowing through the glomeruli in a given time. Normally an increase in the rate of flow can be produced by local vaso-dilatation as in all glands. With marked increase of capillary resistance within the glomeruli, however, it is unlikely that this should suffice, therefore, a stronger demand from the glomeruli goes beyond the local vasomotor system of the kidney, and, reaching the cerebrospinal centers, calls forth a reflex splanchnic vaso-constriction which increases the general blood pressure sufficiently to maintain a normal rate of flow through the diseased glomeruli. In hypertension of unknown origin Krehl has observed extensive lesions in the brain arteries and Loeb suggests the possibility of a vaso-constrictor reflex from this and other organs similar to that suggested to explain nephritic hypertension. This Janeway considers far from improbable. He is convinced that hypertension is a compensatory manifestation and that it expresses an attempt on the part of the organism to maintain an adequate speed of capillary flow through the kidney or other important organ which would be impossible without it. This conception of hypertension he considers as the foundation of any rational treatment.

Davidson <sup>108</sup> in an article on blood pressure in fevers says a sthenic fever is one in which the blood pressure is high while an asthenic fever is one with low blood pressure. Many of the ill effects of fever are, in part at least, due to fall of blood pressure. As a rule pressure is directly proportionate to the temperature, but in fevers, we have another factor to reckon with, namely, intoxication, which lowers the pressure. In simple scarletina Davidson found the blood pressure curve similar to the pulse and temperature curves. In severe anginoid cases the pressure fell as the toxæmia increased. In scarlatinal nephritis the blood pressure was raised while albuminuria was present. Diphtheria showed invariably a fall of pressure proportional to the toxæmia, but if severe albuminuria presented, there would occur a marked rise to above the normal. After administration of antitoxin the arterial pressure nearly always fell or remained the same. Within an hour after the fall in these cases the pulse recovers its normal pressure. Typhoid shows considerable lowering of the pressure which



continues to fall throughout the duration of the case. Davidson mentions a case supposed to be scarlet fever which showed an irregular temperature and a pressure decidedly below normal. On this score typhoid fever was suspected and this suspicion was confirmed by the Widal test.

#### The Blood Serum

Dehne<sup>109</sup> has determined that the turbidity and precipitates occurring in the combination of serum with antiserum are rapidly dissolved if diluted homologous serum be added in excess. This specific solubility reveals precisely the animal from which the blood was taken even when the merest traces of blood are used.

Chauffard and Rendu<sup>110</sup> have adopted a means of determining the normal standard of resistance of red corpuscles. They use a physiological salt solution of 7 parts per mille. This is added to a series of test tubes beginning with 68 drops in the first test tube, 66 in the second, 64 in the third and so on down to 8 drops. Blood is then added to these test tubes and hæmolysis is shown by the fluid's turning pink. They have determined that the average of slight hæmolysis is the tube containing 42 drops, for distinct hæmolysis the tube containing 38 drops and for pronounced hæmolysis the tube containing 12 drops.

By isoagglutination of human corpuscles is meant clumping of the corpuscles of one person by the serum of another. This is readily demonstrated by incubating mixtures of defibrinated or citrated blood or of corpuscles and serum for one or two hours. It has been shown that individuals may be separated into three groups by means of isoagglutination. Group (1) those whose corpuscles are not agglutinated by the sera of groups two and three and whose sera agglutinate the corpuscles of groups two and three. Group (2) those whose corpuscles are agglutinated by the sera of group three and group one and whose sera agglutinate the corpuscles of group three. Group (3) those whose corpuscles are agglutinated by the sera of group two and group one and whose sera agglutinate the corpuscles of group two.

Hektoen<sup>111</sup> says, "all who have worked with the opsonic index are familiar with the fact that occasionally there is shown marked clumping of the erythrocytes which naturally interferes more or less with the desired accuracy. In order to avoid this annoyance the washed blood (leucocytes) should be secured from an individual of group one, that is, from one whose corpuscles are not agglutinable. Hence it is well to determine the isoagglutinative grouping of the regular frequenters of a laboratory who are likely to be asked to furnish blood

for this purpose. In connection with transfusion of blood from one human being to another Hektoen says as follows: "The occurrence of isoagglutinins in human blood suggests that under special conditions homologous transfusion might prove dangerous by leading to erythrocytic agglutination within the vessels of the subject transfused. It may be pointed out, however, that the possible danger here indicated can be avoided by the selection of a donor whose corpuscles are not agglutinated by the serum of the recipient and whose serum does not agglutinate the corpuscles of the latter. That is to say, donor and recipient should belong to the same group and preferably to groups one or two."

In connection with Hektoen's observation it is interesting to note a report by Pepper and Nisbet,<sup>112</sup> who describe a case "of some peculiar, obscure type of hæmorrhagic disease, rather than any of the more definite forms of blood disease." The patient was transfused on two occasions at an interval of two days. On the first occasion the donor was the patient's wife and on the second occasion his brother-in-law donated the blood.

Shortly after the second transfusion the patient showed distinct signs of a rapid and profound hæmolysis. The authors having seen no ill effects reported from this mode of treatment believe that this case should be placed on record in order to show that the procedure is not without danger, and that until our knowledge of the hæmolytic action of different sera is more exact it should be used with caution. They suggest that the first transfusion may in some manner have caused the formation of hæmolytic bodies which after the second transfusion found abundance of vulnerable corpuscles for their operation.

Demel and Sotti<sup>113</sup> have carried out a series of experiments in which they injected cytolytic and hæmolytic sera after inoculation with pathogenic germs. Almost unexceptionally the resulting infection ran a severe course and assumed a hæmorrhagic form. On this ground they believe that the hæmorrhagic form of an acute infection may be due to the production of some hæmolytic or cytolytic toxin.

Marie and Levaditi<sup>114</sup> have applied the hæmolytic test to the cerebrospinal fluid in cases of general paralysis. In negative cases the test was invariably negative, while in thirty-nine patients with general paralysis the test was positive in 73 per cent. In nine cases of tabes it was positive in 66 per cent. In syphilis alone or a brain lesion alone the test was negative and positive only when syphilis was found in both the cortex and the membranes.

Capps and Smith<sup>115</sup> have determined a selective disintegrating action of the X-ray on the blood in leukæmia, the large mononuclear forms and the myelocytes bearing the brunt of the attack. This action, but to a less extent, holds true in vitro. The serum of leukæmics who have improved under Roentgen treatment causes a leucopenia in animals injected with it, and when added to a hanging drop of blood from another individual it causes a leucolysis. This serum also shows a marked agglutinative reaction on normal erythrocytes and other corpuscles. The injection of a strong leucolytic serum of this kind into a patient suffering with lymphatic leukæmia causes a rapid and marked drop in the leucocytic count. Repeated injections bring about an immunity to the serum.

Walker<sup>116</sup> says, "that the confusion and erroneous findings in opsonic work are due to a lack of knowledge of the principles of phagocytosis." He argues that if there are fewer bacteria in either suspension than the opsonin of either serum is capable of sensitizing, the resulting indices will be equal regardless of any differences in the opsonic content and, further, if there are sufficient bacteria to anchor all of the opsonin in the weaker serum, and an insufficient number of bacteria to anchor all of the opsonin in the stronger serum, an error will result equal to the amount of uncombined opsonin in the stronger serum. Hence Walker recommends diluting the sera from 10 to 25 times and using this with a very opaque suspension of staphylococci.

In their study of the opsonins Simon, Lamar, and Bispham<sup>117</sup> advocate the determination of the number of phagocytosing cells instead of the number of ingested bacteria as in Wright's method. Their method gave greater fluctuations than Wright's. They found that digestion greatly influenced the opsonic content. They were able to demonstrate opsonins in exudates to a variable degree but were not able to find opsonins in striped muscle tissue, liver, spleen, lymph glands, kidneys, intestines, mucous membranes, muscular coats, adrenal gland, brain, pancreas, testicles, ovaries, cerebro-spinal fluid, seminal fluid and milk. According to their researches, opsonins are not dialysable and are closely connected with the globulins. They can be removed from the blood serum by various substances. They do not believe in their specificity. They are led to think that perhaps the opsonins are a constant quantity, and that phagocytosis may be influenced by a second factor which is variable.

Moss<sup>118</sup> believes that none of the present methods of estimating the opsonic content are sufficiently accurate to be of any practical value.

Russel's<sup>119</sup> conclusions from his experiments on the specificity of

opsonins are-as follows: (1) Following injections of bacterial vaccines the increase of opsonins is probably due to the formation of immune opsonins which react specifically. (2) In saturation experiments with normal sera we are dealing with normal or common opsonins, and these are not specific since they can be removed by saturation with any one of a considerable number of bodies. (3) In saturation experiments with immune sera we have both the immune and the common opsonin present. The former is quite specific, while the latter is not. (4) *Bacillus pyocyaneus* is susceptible to spontaneous phagocytosis.

According to Noguchi<sup>120</sup> the opsonins act best in neutral media. If the action of opsonins is suspended by an unsuitable reaction of the media these opsonins may be reactivated by bringing the reaction of the media to the neutral point. This reactivation does not take place after the acid or alkali used to suspend their action approaches the strength of 1N at which point the activity of the opsonin is permanently destroyed. The opsonins in sera resist desiccation at 23°C. They can withstand temperatures up to 150° C. in the dry state and may be preserved in this state for two years.

Tunnichiff<sup>121</sup> and Davis have discovered that fusiform bacilli and influenza bacilli are as susceptible to phagocytosis in the presence of normal salt solution as in the presence of serum. This susceptibility held good for fusiform bacilli until the salt solution used had reached 2.5 per cent. when phagocytosis was suspended. The same was true of influenza bacilli in solutions varying from 0.6 to 0.3 per cent.

In their study of opsonins of normal human serum Cowie and Chapin<sup>122</sup> have found that if serum is heated to 55 or 60 degrees C. and to this heated serum there is added normal human serum diluted to  $\frac{1}{15}$ , the resulting phagocytosis is much greater than the sum of the phagocytosis of the sera taken separately. Staphylococci if treated with heated serum and washed are more easily opsonified by a dilute normal serum than if untreated. A serum once heated after previous treatment with a sufficient number of staphylococci cannot be reactivated. These observations seem to favor an amboceptor-complement structure for the opsonins.

#### Diseases of the Ductless Glands

White and Proescher<sup>123</sup> relate the finding of spirochaetes in the aspiration fluid from enlarged glands in acute lymphatic leukaemia and chronic benign lymphomatosis during life. They group together as a primary lymphatic spirillosis the following diseases: Acute lymphatic leukaemia, chronic lymphatic leukaemia, pseudo-leukaemia

(Hodgkins disease), chronic benign lymphomatosis, lympho-sarcomatosis (chloroma and myeloma). They suggest this scheme because in all of the above diseases they have found spirochaetes in sections from the glands in enormous numbers. They succeeded in transmitting the infection to a guinea-pig by subcutaneous injection and in transferring it from this pig to three healthy ones with the same results as found in the first pig; that is the production of an ulcer at the site of inoculation and enlargement of glands in the groins. (The evidence that spirochaetes are present is not good.)

Howard<sup>124</sup> in a study of myxoedema reports in detail ten cases from the clinic of Osler and gives an elaborate analysis of one hundred cases from the American literature.

Hunt<sup>125</sup> has shown that when small amounts of thyroid are fed to mice they later acquire markedly increased resistance to acetonitrile. Further studies showed that this was a delicate test for thyroid. Upon this basis Hunt proposes a physiological test for excessive thyroid secretion in the blood.

Thompson<sup>126</sup> calls attention to the importance of diagnosing atypical Graves' disease, or thyroid toxæmias which are apparently less than Graves'. These sub-toxic states are often interpreted as neurasthenia, hysteria, functional heart disease, anaemia, etc. He is convinced that morbid over-activity of the thyroid is of much more frequent occurrence than is generally supposed.

Sawyer<sup>127</sup> describes a peculiar distribution of the hair as among the physical signs of exophthalmic goitre. In a great number (600) of these cases the eyebrows were scanty, often the axillæ were more or less free of hair and the growth over the legs was absent. The hair of the head often showed two zones; the narrower running around the lower edge of the temporal regions was apt to show gray or sometimes a fringe of white.

Thompson<sup>128</sup> after a study of the parathyroid glands in twelve cases of infantile atrophy concludes as follows: In primary infantile atrophy the parathyroid glandules show changes which may be degenerative in type, but which are, for the most part, progressive, and consist in replacement of a varying amount of the gland parenchyma by connective tissue stroma. These changes are similar in nature to those which are constantly present in the thymus gland in this disease. The progressive changes are present in the ductless glands and become especially apparent in long standing cases of the disease. The author does not wish to imply that these various glands are primarily at fault in this disease, but he wants to emphasize the fact that failure

of assimilation in this disease leads to wider changes than simple wasting of fat and muscle.

Cagnetto<sup>129</sup> from histologic findings believes that acromegaly is not dependent upon excessive functioning of the pituitary body.

Zinninger<sup>130</sup> reports two cases of Addison's disease with fatal termination, one showing pigmentation and the other not, and both showing extreme myosis.

#### Diseases of the Blood

Schleip<sup>131</sup> describes the peculiar ring bodies seen in the red corpuscles in a case of pernicious anæmia by Cabot. He has seen them in secondary anæmia, chronic lead poisoning, and leukæmia.

Westenhoeffer<sup>132</sup> reports a case of true plethora, the diagnosis being confirmed by the pathological findings. He believes this condition to be an infantile phase of the marrow of the long bones that has persisted. This is the fifth case on record.

Hirschfeld<sup>133</sup> suggests the term "erythremia" for the condition known as polycythæmia with enlargement of the spleen. He considers this condition a twin to leukæmia, hence the term. In the former the erythroblastic apparatus is involved, while in the latter the leucoblastic apparatus is involved. In cases where there is an increase in the number of red cells, which is merely transient or secondary he suggests the term "erythrocytosis."

Aldrich and Crummer<sup>134</sup> report a case of polycythæmia in which the blood showed, more definitely than in any cases published hitherto, the signs of an irritative lesion of the bone marrow (megakaryoblasts and myelocytes); thus in a great measure substantiating Turk's assumption that polycythæmia is in reality a primary disease of the red bone marrow.

Saundby<sup>135</sup> believes polycythæmia with enlargement of the spleen to be a cerebrospinal neurasthenia which causes vasomotor spasm. He attributes the condition to the effect of the toxins of influenza, and many other infections.

Anders<sup>136</sup> discusses chronic polycythæmia and cyanosis with enlarged spleen. He cites three cases and gives tabulated analysis of nineteen cases. He considers as probable that there is a form of primary polycythæmia of unknown etiology, characterized principally by marked polyglobulism and other hæmic features, cyanosis, headache, vertigo, and splenic enlargement; but, this, he says, must be of rare occurrence, while it is clear that the majority of cases which have been reported and classed as instances of this condition have had

a different pathological etiology, although closely simulating the primary variety clinically.

Rowley<sup>137</sup> reports the presence of atypical phagocytic cells in the blood of three cases of lymphatic leukæmia and one of tertian malaria. These cells vary in size and shape and may have one or more nuclei. They may contain erythrocytes or even other leucocytes. They stain like the large lymphocytes with Wright's stain.

In a study of the polynuclear leucocytes, Kaplin<sup>138</sup> has determined that normally the leucocytes containing two or three nuclei are in greatest number, those containing a single nucleus come next in order, and cells having four, or five nuclei are least in number. This relationship is changed in certain pathological states, the cells with two or three nuclei being decreased and those with one nucleus markedly increased. In the beginning of a disease there is a rapid increase of the single nucleus cells and this increase continues as the disease grows worse and remains stationary when the disease is stationary. As the disease subsides the one nucleus cells decrease in number and the two or three nuclei cells, increase. He has found that the single nucleus cell is most active as a phagocyte, taking up more staphylococci than the others, and that the phagocytic power of the cells decreased as the number of the nuclei increased, so that the cells of five nuclei showed practically no phagocytic action.

Muehlman<sup>139</sup> has discovered by means of the ultra-microscope that Mueller's blood dust, or hæmakonia, consists of particles of fat in the blood.

Bartlett<sup>140</sup> reports a remarkable case of localized leucocytosis. Counts made from the lobe of the ear ranging from 30,000 to 300,000, while those from the upper part of the ear, and from the other portions of the body remained about normal. These extraordinary counts varied greatly from day to day and even from hour to hour.

Blumgar<sup>141</sup> looks upon a diminution of eosinophiles associated with a distinct leucopœnia as favoring a diagnosis of typhoid in doubtful cases, while, on the other hand, an increase in the number of the eosinophiles is against this diagnosis.

Freytag<sup>142</sup> after investigation believes the eosinophile granules in leucocytes to be the visible expression of their iron content. These cells take up the iron from the red cells of the blood.

Van Nuys<sup>143</sup> reports an interesting case in the blood of which large basophilic phagocytic cells were found. There were two varieties: one was a large mononuclear cell, the other was a multinuclear giant cell. The patient showed enlargement of the liver, and

the spleen, and in the region of the descending colon two hard, egg-shaped masses could be palpated, which were deep and immobile. The patient was suffering from beef tape-worm, and the eggs of *trichocephalus dispar* were noted.

Erb, Jr.,<sup>144</sup> reports acute leukæmia in connection with streptococcic sepsis. He believed the septic infection to be secondary to the leukæmia.

Ziegler and Jochmann<sup>145</sup> report a case of acute leukæmia following septic staphylococcus hæmorrhagic pericarditis which had been preceded by acute tonsillitis.

Simon<sup>146</sup> reports a case of compound fracture of the right ankle, in which examination of the blood revealed a typical picture of myelogenous leukæmia. The patient was suffering from a cellulitis at the time of the examination. One week after amputation of the leg in the lower third there was a return to the normal in the blood picture.

Bunting<sup>147</sup> in his work on experimental anæmia found that by injecting a large dose of ricin or saponin or some other hæmolysin directly into the veins one gets the blood picture of a primary anæmia, and that by the injection of the same dose or even a larger one subcutaneously, when absorption into the circulation is slow, one gets the picture of a secondary anæmia. A similar difference occurs in the marrow pictures. He says: "herein lies the explanation, I believe, of the relation of anæmias of the pernicious type to those of the secondary type, due to causes other than hæmorrhage. That is, in a disease like tuberculosis in addition to the general malnutrition there is a constant but slow absorption into the circulation of substances destructive to red blood cells. This absorption, however, is so gradual that the toxin is completely anchored by circulating red cells, causing their destruction or injury, as shown by the splenic accumulation of blood pigment, but does not reach the marrow in an uncombined state. As a result, the marrow escapes injury. On the other hand, in pernicious anæmia in some periods, large quantities of hæmolytic poison gain entrance into the circulation, are not completely combined with circulating red cells and reach the marrow, there to cause destruction not only of the mature red cells but of nucleated red cells. The function of the marrow is impaired, leading to a faulty response to the call made on it to repair the lesion and the blood picture of pernicious anæmia is the result."

Talquist<sup>148</sup> has found a powerfully hæmolytic lipid substance in the sexually perfect segments of the *bothriocephalus latus*. This



substance produces no antibody and resists boiling and the action of proteolytic ferments. The substance is not excreted but when a segment becomes disintegrated it is set free, and this is sufficient to explain the bothriocephalus anæmia. No other tape worm shows the presence of this hæmolytic substance.

Addison's<sup>149</sup> anæmia according to Hunter is a definite specific, hæmolytic, infective disease. In addition to the anæmia there are gastrointestinal and toxic symptoms not caused by the anæmia itself, but by the underlying pathogenic agents. It is associated with a history of preceding oral, gastric or intestinal disease of a septic nature, existing for a long period of time, and followed by a rapidly developing anæmia characterized by hæmolysis. He lays stress on the occurrence of oral sepsis.

Freund<sup>150</sup> reports a case of pernicious anæmia in which hæmolysis was augmented by urinary retention. He explains this on the ground that the hæmolytic substances which should have passed off in the urine are retained in the general circulation. "Intermittent or cyclical hæmolysis is the rule in pernicious anæmia, consequently when the poison that is normally being excreted from the kidneys is added to those already active in the circulation increased hæmolysis is to be expected."

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# SURGERY

BY JOS. C. BLOODGOOD, M.D.

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FUTURE progress in the development of surgery, and especially in the improvement of the immediate and ultimate results of surgical treatment, depends as much on the education of the general practitioner as upon the special development of the operator.

In every disease amenable to surgical treatment there is a period in which treatment gives the best immediate and permanent result. The symptoms of this earlier stage are more obscure and, naturally, the diagnosis is more difficult. The general public seek first the advice of the family physician. For this reason upon his diagnostic ability depends the time in which the surgeon will be given an opportunity to use his specially developed training.

The urgent need of post-graduate study and instruction is becoming a prominent question in this country. Not only must the physician who has the special training to practice surgery feel the responsibility of keeping up with the times, but the general practitioner must recognize also that his responsibility is equally as great to give the better trained surgeon an opportunity to practice his art and science in the earlier stage of surgical diseases.

The public should also be educated to seek the physician's advice earlier than in the past. The inestimable good that has been accomplished in the propaganda in educating the public as to the prevention and treatment of tuberculosis should, in the natural course of events, be attempted for diseases in which early operative intervention is the most important factor of the treatment.

The public and the profession are now not only familiar with, but convinced of, the importance of immediate operation in acute appendicitis and strangulated hernia.

Post-graduate study on the part of the general practitioner can be pursued in many ways. He will find that more careful records of his cases will, in time, accumulate a wealth of personal observations of a value, equal to, if not greater, than that of his library. Such personal records must be indexed. The physician should, if possible, witness the operation performed upon his patient. He then will be able to compare the clinical picture which he has observed with the

pathological findings at the operation. It is the repetition of such daily comparisons that makes the operative surgeon a more acute diagnostician. In this country, even in hospitals, autopsies are the exception rather than the rule. The public should be influenced to look upon autopsies as essential to the good of the community, that knowledge gained from such post-mortem examinations is as vital to the health of the nation as experimental investigation upon animals and all laboratory research work. The physician in general practice should visit large hospital clinics at more frequent intervals. At the present time it is usually the specialist that goes about to keep himself familiar with progress rather than the physician who devotes his energies to general practice. In the busy life of the average practitioner little time is given to reading, and he is seldom familiar with more than the literature of his own language.

I believe it is the duty of the surgeon to stimulate, to encourage, and to aid the post-graduate instruction of the general practitioner. Along this line there is as much opportunity for promoting progress in surgery as by the means of special investigations and instruction of himself. What good can the now almost perfectly developed technique of pylorotomy accomplish, if cancer of the stomach is not referred to surgery earlier? Gynæcologists have apparently reached their limit in the radical removal of cancer of the uterus. The future of this operation in increasing its percentage of cures, depends entirely upon the education of women and of the general practitioner in their attitude towards uterine hæmorrhage, and upon the efficiency of gynæcological pathologists in the examination of uterine scrapings. The diagnosis of a cancer of the uterus in its earliest period can only be made by the microscopic study of the tissue removed by a curette, and such an examination should only be made by one with the proper training. In cancer of the breast there is little hope of increasing the percentage of cures by an operation more radical than Halsted's, and recent statistical studies bring out the fact that the probability of a cure depends as much on the early radical removal as on any other factor.

When women seek their physician's advice the moment they feel a tumor of the breast, and their physician immediately, as he should, shifts the responsibility to the surgeon, the latter is confronted with a new and more difficult problem.

The majority of tumors of the breast, innocent or malignant, when observed quickly after their first notice by their hosts, cannot be differentiated. The diagnosis must be made when the tumor is exposed by

the surgeon as he explores it with the knife, and the extent of the operation is based on its appearance. The operative surgeon, therefore, must be his own pathologist.

Progress, then, is intimately connected with the education of the public, with the general practitioner, and with the specialist, and one can read the signs that this healthy progress is going on in this country, and each one of us can feel that he has a part to play for the general good of humanity, in the prevention and cure of diseases.

### The Preparation for Operation

The immediate mortality of anæsthesia and operative intervention is becoming so small that the profession and surgeons incur a risk in allowing this to influence their judgment in a decision in a doubtful case.

Surgical operation may be divided into two great groups: In the first, emergency operation—time is the most important factor. In the second group, there is always an opportunity for the most careful investigation, and a delay for this will involve no risk to the patient.

In the so-called emergency operation for acute surgical lesions the chief danger is the possibility that some acute disease in which operation is contraindicated is presenting itself with symptoms difficult to differentiate from one in which immediate operation is demanded. In a patient exhibiting symptoms of some acute abdominal trouble the possibility of a pneumonia, a diaphragmatic pleurisy, a purpura, or some acute infectious disease, must be borne in mind. If such possibilities are considered and the patient is given a careful examination, such mistakes, although possible, will be less frequent.

In the non-emergency cases, the more obscure or doubtful the picture, the more painstaking and thorough should be the investigation. It is in this group that the possibility of some neurosis should be borne in mind. In the last two years many valuable contributions have appeared on this important medical group. I am of the opinion that surgeons can, with justice, criticize themselves for their failure to recognize the greater importance of considering in their differential diagnosis the possibility that the symptom-complex suggesting some operable lesion may be due to a neurosis. In chronic abdominal affections this possibility stands out most prominently.

In the preparation, therefore, for an operation, diagnosis counts first. In emergency cases the chief questions to answer are: Are the symptoms present those of a lesion for which an operation is necessary, and is the danger of an operation less than the danger of delay?

When these can be answered in the affirmative, an operation must be performed.

In acute abdominal lesions, like appendicitis, obstruction, intestinal perforation and pancreatitis, the earliest intervention is the most important factor. One of the most difficult things is to establish in one's mind the minimum of symptoms which will justify intervention. When the maximum of symptoms are present diagnosis is easier, prognosis worse.

The diagnosis having been made and operation decided upon, two problems now confront the surgeon only:—the preparation of the patient, the choice of anæsthesia. In emergency cases there is little time for the usual preparation. There are cases, however, in which a rectal examination will reveal impacted fæces. An enema given now will be more effectual than after operation, and the rectum will be prepared for salt solution necessary after the operation. The question of whether the stomach should be washed out before, during or after operation must be decided. It has been my observation that the technique of washing out the stomach and its indications in surgical practice are not well understood, and its employment when indicated is frequently neglected. The choice of the anæsthetic I will discuss later under anæsthesia. In the majority of patients morphia given hypodermically with atropine, one-half an hour before ether is started, is an important adjunct. In my experience the same administration immediately before the administration of the general anæsthetic does more harm than good. Unfortunately the majority of patients on whom emergency operations must be performed, have suffered pain and have been given enough morphia. This fact should always be ascertained and appreciated by the surgeon.

### Operative Technique

The tendency of most surgeons in their actual work is toward simplifying, within the confines of safety, the technique of operations. The literature on this subject is on the whole scanty, but one becomes convinced of this by visiting many clinics and from personal conversation.

There is, and should be, no restriction in the rigid aseptic part of the technique. The hands should be protected with gloves. The consensus of opinion favors the rubber glove. The arms should be protected with a long sleeve. This part of the technique is often neglected, but it is impossible, in surgical operations, to keep the forearm and elbow out of the field of the operation. For this reason



gowns with long sleeves are indicated. The increasing tendency to protect the mouth, I believe, is a very important addition, especially for surgeons who must teach during operations. It has been demonstrated from experimental studies that during speech particles of saliva are projected.

The chief controversy or difference of opinion among surgeons is in regard to the cleansing of the hands and arms of the operator and assistants and the skin of the field of operation. Perhaps the most important part of this technique is scrubbing with soap and water. A number of surgeons are content, after this mechanical cleansing, to use alcohol and ether; others employ in addition bichloride, a few others turpentine. The additional use of permanganate of potassium and oxalic acid has been omitted in the majority of clinics. It is still employed in Dr. Halsted's clinic. During the summer months, when the number of assistants was small and all of considerable experience, this part of the technique was omitted without any apparent difference in the results. I am of the opinion, however, that in those surgical clinics in which it is necessary, for teaching purposes, to have a larger number of assistants, and where at almost every operation, untrained men clean up, that there should be no restriction in the technique of washing the hands. Every additional mechanical and chemical disinfectant is another safeguard.

The part of the technique of cleansing the skin which requires the most time, and for this reason is often curtailed, is the mechanical scrubbing with soap and water. This should be performed for at least five minutes by the clock, with constant additions of fresh water. I am of the opinion that further cleansing should at least be done with ether, alcohol and bichloride.

In the experience of the surgical clinic of the Johns Hopkins Hospital and my own, the results in the healing of wounds have been so uniformly good for so long a time, that one would hesitate to change the technique or introduce new methods. The only objection to permanganate of potassium and oxalic acid is the additional time and cost.

**SUTURES.**—The prevailing opinion now favors catgut. For many years I was prejudiced against this suture material, but an experience now of over two years has demonstrated that this prejudice was unfounded. If one can be certain of the preparation of the catgut, it is just as good a suture material as silk. It has the advantage that it can be used as a continuous suture *ad libitum* in the closure of wounds. Experience shows that such catgut need not retain its strength more than ten days.

Catgut is not applicable as a suture or ligature in all cases. With good technique one should have no fear of silk. The test of the technique of a surgical clinic is the fearless use of silk. The employment of silk can, of course, be carried to an extreme. It does not compare with catgut as a continuous suture for the closure of abdominal wounds. For the suture of vessels and the ligation of large vessels and their branches, silk should be preferred. When a fine suture material is necessary silk answers the purpose best. For the closure of the skin I have never been able to get the same perfect results with catgut. Silk or silver wire give the best results. The continuous subcuticular suture of Halsted, with silver wire properly introduced, I believe, gives the most perfect wound. It is not a good suture to employ when the wound is not absolutely dry and one expects some oozing. Here interrupted silk meets the indications. In closing the skin after thyroidectomies one should employ interrupted silk, and in wounds of the face. In all wounds in which a surgeon is anxious to make a perfect skin approximation and to allow for no oozing, the Halsted suture meets the requirements.

**DRAINAGE.**—There is nothing particularly new on this subject, nor have any special advances been made. With good technique and a dry wound, when the operation has been performed for non-infectious lesions, drainage is practically never necessary. The decision when and how to drain is one of the arts of surgery and can be better discussed with the different operations. It is a detail, however, of technique that should be given the most careful consideration.

The results in the healing of the wound after surgical operations to-day depend not so much on the methods of technique, because they are well established, but upon how the details are carried out. Hospitals are becoming so clean, infected wounds and infectious diseases, like erysipelas, so rare, operative interventions with good results so common, that there is a tendency to relax in the extreme vigilance over the technique. When carelessness creeps in, I am sure that careful records will show an increasing number of infected wounds.

**INFECTIONS.**—In the treatment of many infected wounds and infections the limitations of operative intervention have been reached. Bier's great work on hyperæmia has undoubtedly added to the surgeon's armamentarium. Properly employed in time, in some cases, hyperæmia will combat the infection alone; in other cases it will limit the extent of the operative intervention. The danger of employing this method too enthusiastically is that the indicated operation may be postponed too long (Fig. 1). Surgeons must learn the proper

methods of using the elastic bandage and the vacuum cups. There is no space here for a discussion of these details. The last edition of Bier's book is published (*Hyperæmie als Heilmittel*. 5-te Aufl., F.C.W. Vogel, Leipzig), and there are a few contributions in American literature. Surgeons must study when to combine operation with hyperæmia.

The vaccine therapy has not given as yet the results that were hoped for. In the very acute infections it is of no value, and in some of the chronic infections it has not accomplished results much better than are obtainable by other methods. Investigations along this line and clinical work should continue, and surgeons should encourage in every way men who are devoting themselves to this method of investigation and treatment. Cultures should be taken from all infected cases, and the bacteriologist requested to make vaccines; these should be employed under the supervision of one trained in Wright's methods.

For practical purposes, in the treatment of infections, and in the conception of inflammatory processes, I have found great aid in Bier's book and in Adami's monograph on inflammation (published by McMillan Co.) and some experimental work by Dr. Opie which I witnessed in the Rockefeller Institute in New York. Some of these investigations have been published (*Jour. of Experimental Med.*, Nov., 1905, vol. vii; May, 1906, vol. viii; Aug., 1906, vol. viii; September, 1907, vol. ix). I strongly recommend the reading of these books and papers.

**EPITHELIAL TUMORS.**—The surgeon is constantly called upon to differentiate between the ulcer or fungus situated on the skin or mucous membrane due to a new growth or some inflammatory process. When this lesion is situated on the skin of the extremities, neck or body, its complete excision is simple, and gives the best results whatever the nature of the lesion. But when the part involved is the tonsil, the tongue, the nose, the lower lip, the eyelid or the penis, one does not wish to proceed with a radical operation until the diagnosis of a malignant tumor is clearly established.

When an ulcer appears on the mucous membrane or skin of a vascular area from any cause and does not heal rapidly under appropriate treatment one should be suspicious of a new growth or a specific infection. As a rule the differential diagnosis is not difficult. For example, in Fig. 2, there is an ulcer on the nose and upper lip. The multiplicity of the lesion is of itself against a malignant epithelial tumor, especially the squamous-cell epithelioma (*epithelioma spinocellulare malignum*). This malignant epithelial tumor is almost

FIG. 1.



Sinuses following post-typhoid osteomyelitis of the ribs, not relieved by prolonged use of Bier's vacuum cup.

FIG. 2.



Syphilitic ulcers of nose and upper lip.

**FIG. 3.**



**Simple ulcer of tongue.**

unique on the upper lip and rarely attacks the skin of the nose. The diagnosis, therefore, rests between a basal-cell epithelioma (rodent ulcer) and a specific infection. Neither ulcer has the indurated edge of the squamous-cell epithelioma. Both ulcers have formed more rapidly than is usual for the basal-cell tumor, and necrotic tissue can be seen in the granulation-tissue surface. There is every evidence, then, that the ulcers are due to some specific infection, probably luetic. In such a case radical excision would be associated with great mutilation, and should not be performed without a positive diagnosis. This patient had been treated for six weeks with the X-ray with no evidence of healing. In the basal-cell epithelioma exposure to the Röntgen rays is usually followed by at least some appearance of healing, sometimes complete healing. From this evidence I felt quite certain that the ulcers were syphilitic. They healed rapidly under proper general and local treatment.

In the ulcer of the tongue illustrated in Fig. 3 the differential diagnosis was much more difficult and important. If this ulcer was carcinoma a most radical operation was indicated. The patient was at the cancer age; this position is quite common for squamous-cell epithelioma; the ulcer had been present two years; when it first appeared there were also ulcers on the mucous membrane of the lips and on the roof of the mouth; the latter healed very quickly; the present ulcer has resisted local and general treatment, yet, in spite of this, it is still superficial and has the induration of cancer only at one small area at the edge. I had never seen a carcinomatous ulcer of such a size without a definite indurated border, and it was hard to conceive of a malignant epithelial tumor of two years' duration remaining so superficial. To accomplish healing I excised the ulcer under cocaine and closed the defect. The wound healed and there has been no recurrence. Microscopically the ulcer was composed of chronic inflammatory tissue; the muscle base showed chronic interstitial myositis; there was no histologic evidence of syphilis or tuberculosis.

The different forms of epithelial tumors of the skin and mucous membrane I have discussed in my former reviews in the *INTERNATIONAL CLINICS*.

#### Surgery of the Bones.

**BONE TUMORS.**—In these *INTERNATIONAL CLINICS* since my first review of surgery in 1904 and in the December numbers of *Progressive Medicine* since 1899, I have brought forward evidence from the literature and my own experience which demonstrates the different degrees of malignancy in periosteal and medullary tumors of the long pipe

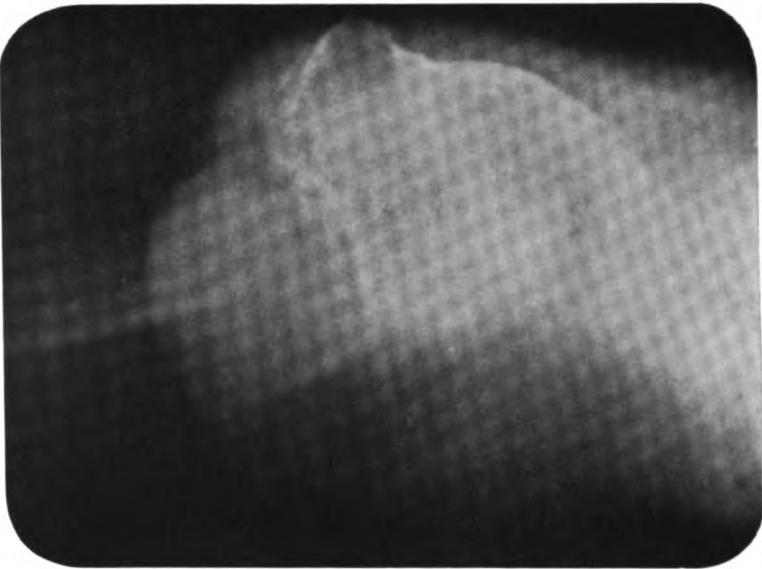
bones and the jaw, and that with this knowledge surgeons are justified in restricting the operation in the less malignant tumors and removing them, if possible, without mutilation. Before the American Association of Orthopædic Surgeons last May I summarized the less malignant tumors, their clinical and pathologic characteristics and the appropriate treatment for each (published in the *Amer. Jour. of Med. Sciences*, Feb. 1, 1908, vol. vii, p. 325).

**BONE CYSTS.**—Of the benign lesions this is the most interesting and most frequent. Yet, the medullary collection of fluid which uniformly expands and thins the cortical bone, cannot be differentiated in its early stage from a malignant medullary tumor, and I agree with Helbing that the X-ray picture is not characteristic as claimed by Beck.

Fig. 4 is the X-ray which shows the expanded lower end of the femur. I am of the opinion that from this X-ray a diagnosis of a bone cyst should be made. No other medullary tumor could produce such a huge and uniform expansion without breaking through the cortical bone. Note in the picture that the cystic femur overlaps the tibia. This patient, a woman now twenty-seven years of age, had her first symptoms twelve years ago. This X-ray was taken five years ago. She has constantly refused intervention. For the last four years there has been absolutely no growth. The patient retains full motion at the knee-joint and is able to walk with a cane. Colvin, of St. Paul, has recently sent me X-ray studies of a bone cyst which he has observed a number of years. Measurement and the X-ray indicate that the cyst is becoming smaller. Dr. McMaster, of Sauk Center, Minnesota, has just written me that he has observed what appeared to be a bone cyst of the lower end of the femur, which has been present for a great number of years and had given no trouble up to the time of the patient's death at the age of seventy-three.

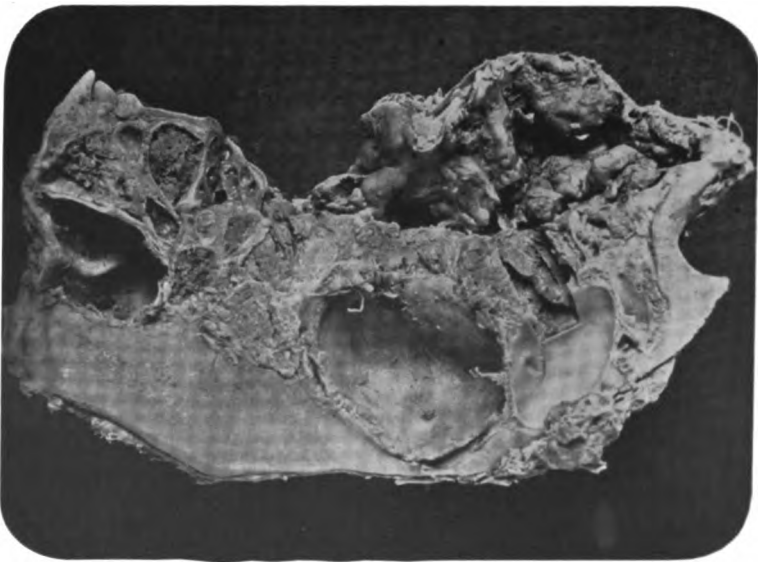
The accumulated experience, however, demonstrates that the permanent results are better if these cysts are opened, curetted and part of the bony wall removed. In the early stage when a differential diagnosis cannot be made, operation is imperative to exclude a more malignant tumor, especially the giant-cell sarcoma. Now and then when the suspected bone cyst is explored there is a small or no cavity, but the distended medullary space is filled with a cellular young connective tissue in which there may be red areas like currant-jelly (giant-cell areas), or cartilage. This must not be mistaken for a sarcoma. It is simply benign cellular connective tissue the etiology of which is neither established nor understood. It is called localized osteitis fibrosa, a name given to it by v. Recklinghausen, who observed it first as a

FIG. 4.



Benign bone cyst of lower end of femur. (X-ray) Baetjer.

FIG. 6.



Adamantine epithelioma of lower jaw with cyst formation. Section, alcohol specimen, by Schapiro.



FIG. 7.



Malignant naso-pharyngeal tumor.

general disease of the skeleton. Fig. 5 (Fig. 3, Plate II) shows the fresh appearance of a myxo-chondroma of the ankle-joint which does not differ much from *ostitis fibrosa*. Bone cysts and *ostitis fibrosa* should be studied together. The recent literature contains a number of interesting contributions. Pfeiffer (*Beiträge z. klin. Chir.*, 1907, vol. liii, p. 473), in his paper on *ostitis fibrosa* and the genesis and therapy of bone cysts, reports four cases with beautiful illustrations and supports Rehn's theory of localized *ostitis fibrosa*. Tietze (*Beiträge z. klin. Chir.*, 1906, vol. lii, p. 495), in his second paper on bone cysts, in which there is an excellent review of the previously reported cases, agrees with Pfeiffer. Bockenheimer (*Archiv f. klin. Chir.*, 1906, lxxxi, part i, p. 236) also inclines to the view of the etiologic relations between cysts and *ostitis fibrosa*. His case and the one reported by Tietze are of interest, because the cysts recurred after a period of three years. In these two cases nothing was done except filling the cavity with iodoform and glycerine. Space forbids a further discussion of this remarkable disease which should be recognized on account of its benignity. I have in preparation, and will soon publish, a number of personal observations, with a discussion of the literature.

**DENTIGEROUS CYSTS OF THE JAWS AND ADAMANTINE EPITHELIOMA.**—In the jaws the embryonic residues of the epithelial and mesoblastic dental organs may give rise to periosteal and medullary growths. The dentigerous cyst always has a bone capsule. The adamantine epithelioma usually has a similar capsule, but may appear like an epulis. The latter I have illustrated in the *INTERNATIONAL CLINICS* (vol. i, Seventeenth Series, 1907, p. 274, Fig. 19). The dentigerous cyst is strictly benign and can be permanently cured by curettment of the connective-tissue lining and the removal of sufficient of the bony wall to correct the deformity. The adamantine epithelioma must be completely excised. In some cases, I believe, subperiosteal removal is sufficient. Fig. 6 is a photograph of such a tumor illustrating the cysts and the solid epithelial areas.

The proper treatment of tumors arising from, and in the region about, the upper and lower jaw require an accurate knowledge of the pathology and the relative malignancy. In the past radical and extensive excisions with great mutilation and considerable mortality have been practiced. A careful clinical and pathological study which I have just finished in preparation for a chapter on this subject in *Bryant and Buck's System of Surgery*, confirms the conclusions arrived at in 1903, and a study of the literature brings out only evidence in its favor.

In the so-called carcinoma of the upper jaw in which the malignant epithelial tumor arises either in the mucous membrane of the antrum or nose, most frequently from the latter, and quite often with a history of nasal polypus, permanent cures have not been accomplished by the most radical procedures. Most of these cases were first observed by the rhinologists, and it appears to me that the problem is up to them. They must differentiate between the benign and malignant polypus, and for the latter do a more radical operation, or refer the patient to a surgeon. Rosenheim (*Johns Hopkins Hosp. Bull.*, June, 1906) gives an excellent resumé of the benign nasal polypi.

The spindle-and-round-cell sarcoma and the more malignant perithelial and endothelial angiosarcoma, like the carcinoma, are rarely, if ever, cured. Permanent results are obtained only in the less malignant tumors—the dentigerous cyst, the adamantine epithelioma, the various forms of epulides, the giant-cell sarcoma which may appear as a medullary tumor in the lower jaw and the different varieties of fibro- and myxosarcoma. In these latter, less malignant tumors, conservative operations less mutilating, if the tumor is small, give equally as good a result as the radical procedure with mutilation. Therefore, if a surgeon is to err, it is better to do so on the side of conservatism. For the orbital tumor reported and illustrated in the *INTERNATIONAL CLINICS* (vol. i, Fifteenth Series, 1905, p. 290, Figs. 14, 15 and 16) a very conservative operation was practised. All but the anterior wall of the upper jaw was left; the encapsulated tumor was practically curetted out of the antrum. This patient has just sent me a photograph of himself, now four years since the operation. There is no deformity. The tumor was a periosteal fibro-myxosarcoma, and in places quite cellular.

**NASO-PHARYNGEAL TUMORS.**—These neoplasms which spring from the connective tissue at the base of the skull, in the pharynx and posterior nares, are of great interest, and for their removal special technical operations are necessary. Fig. 7 illustrates the clinical picture of such a tumor. The more malignant varieties of these tumors are absolutely incurable—the carcinoma and the cellular sarcoma, but excellent results have been obtained in the less malignant and distinctly benign tumors. The latter may reach the same size as the former, produce exophthalmos, fill the nares and protrude, enter the antrum or produce a bulging in the temporal fossa. The operable tumors are encapsulated, they arise from a more or less restricted base, and in their growth push away tissue, but do not infiltrate. Payr (*Archiv. f. klin. Chir.*, 1903, vol. lxxii, p. 284) gives a very good

paper on the modern methods for the operative treatment of tumors of the nasopharyngeal space, with special consideration of Kocher's osteoplastic temporary resection of both upper jaws for their removal. Payr considers chiefly the fibroid tumor or the so-called basal fibroma. Pincus' paper (*Archiv. f. klin. Chir.*, 1907, vol. lxxxii, p. 110) is a very comprehensive contribution to the surgery of the naso-pharyngeal space, a careful description of its peculiar anatomy, an excellent study of the clinical picture and pathology of the various tumors, and the different operative procedures. A paper along similar lines has previously been written by Custodis (*Beiträge z. klin. Chir.*, 1905, vol. xlvii, p. 37). Habs (*Deutsche Zeitschr. f. Chir.*, 1898, vol. xlvii, p. 100) has originated a special method—a temporary resection of the hard palate which was successful in his case of angiomyxofibroma of the nasopharynx.

**GIANT-CELL SARCOMA.**—Of all bone tumors this is the most important. It is not only quite frequent in its occurrence, insidious in its growth, but among the malignant sarcomas of bone the most amenable to conservative treatment. The gross appearance of the tumor is very characteristic (*INTERNATIONAL CLINICS*, vol. i, Seventeenth Series, 1907, p. 272, Fig. 20). In my experience it represents a neoplasm most easy to diagnose from a rapid frozen section (*Ibid.*, p. 274, Fig. 18).

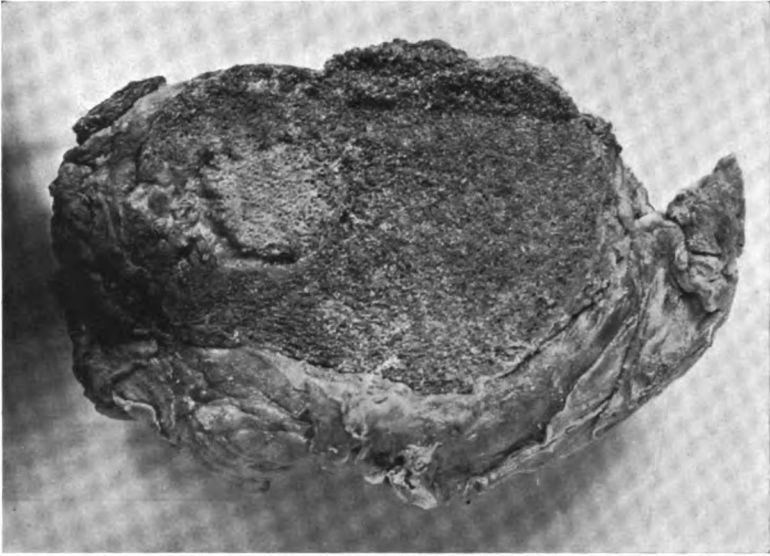
As a periosteal tumor it is perhaps the commonest form of epulis. Very infrequently does it appear as a periosteal growth on the long pipe bones (*Ibid.*, 1905, Seventeenth Series, p. 219, Fig. 18). I have seen it twice situated in the medullary cavity of the lower jaw at the symphysis, in both cases about an unerupted tooth (*Ibid.*, 1907, Seventeenth Series, p. 272, Fig. 20). This tumor occurs most frequently as a medullary growth of the long pipe bones and is situated near the epiphysis (*Ibid.*, 1905, Fifteenth Series, p. 290, Fig. 19). In the series of cases in the surgical pathological laboratory this giant-cell medullary tumor has been found most frequently in the lower end of the radius. In all of these cases the tumor appeared after traumatism, and in at least half the cases, with a distinct history of fracture. Pain is the symptom of onset, followed by a gradual swelling due to uniform expansion of the cortical bone. The X-ray shows a distinct medullary tumor which in early cases cannot be differentiated from a myeloma Fig. 8 (Fig. 1, Plate I), a cyst, or rare cases of tuberculosis Fig. 9. As the tumor enlarges and the bone shell becomes thinner palpation elicits parchment or ping-pong-ball crepitation; in a very few cases there may be pulsation. This is due to the great

vascularity of the tumor, and is most frequently observed in the periosteal growth. So far, among the cases of which I have records and in the literature, no examples of metastasis have been recorded. Permanent cures have always been accomplished even in recurrent tumors. In many instances the tumor has been cured by curetting (INTERNATIONAL CLINICS, 1905, Fifteenth Series, p. 292, Fig. 19).

Fig. 10 illustrates a giant-cell sarcoma of the lower end of the radius. This observation is of interest, as it represents a recurrent tumor. The patient was a male aged twenty-nine, and the swelling of the lower end of the radius appeared twenty months ago, shortly after an injury. Four months after the onset it was diagnosed tuberculosis and curetted: about one year later a second similar operation was performed, and six months before I saw the patient the lower end of the radius was resected. The X-ray demonstrated the absence of the lower end of the radius and inspection and palpation a tumor occupying this space. The hand was dislocated to the radial side Fig. 11. At the operation the tumor was distinctly encapsulated; it occupied the space of the lower end of the radius, between the flexor and extensor tendon; it was easily removed without injury to the latter; the surrounding bones were not infiltrated. To correct the deformity and to restore the continuity of the wrist and hand, I resected the lower end of the ulna with its periosteum, transplanted it bodily below the shortened radius, thus making the two bones of equal length. The transplanted piece of ulna was held in place by suturing muscle around it. The result is shown in Fig. 12. It is now six months since the operation; there is no evidence of recurrence, and the function of the arm is almost completely restored.

In a very recent case operated on in Dr. Halsted's clinic the giant-cell tumor expanding the lower end of the radius was to me of unusual interest, due to the fact that in the distinctly hæmorrhagic giant-cell tumor there were definite cellular connective-tissue areas which in the gross and under the microscope resembled *ostitis fibrosa*, discussed under bone cysts. Fig. 13 is a photograph of the sagittal section through the fresh tumor. The distinctly white area in one portion represents *ostitis fibrosa*; the dark areas which in the fresh looked like currant jelly are giant-cell sarcoma. This portion of the tumor, in the gross and microscopic appearance, is identical with Rehn's case of multiple *ostitis fibrosa*, in which he found similar currant-jelly red areas of giant-cell sarcoma. Throughout this tumor, as shown in the photograph and confirmed by the microscope, there is more cellular connective tissue than is usually seen. It appears to me that

**FIG. 9.**



**Tubercular caseous focus in the femur. Section: alcohol specimen.**

**FIG. 10.**



**Recurrent giant cell sarcoma, lower end of radius. Photograph of specimen showing encapsulation. Fresh specimen.**

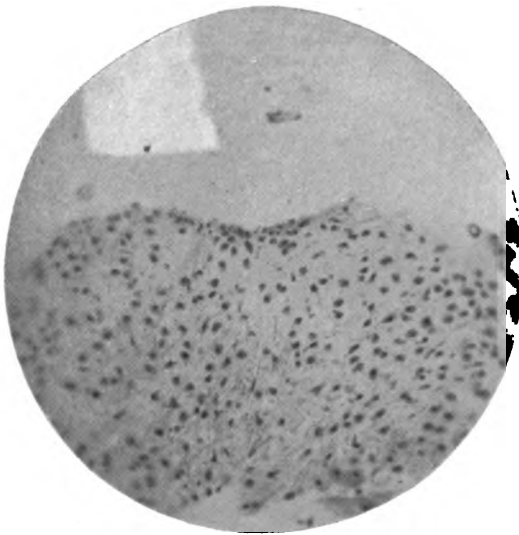


**FIG. 14.**



**Photomicrograph of cicatricial keloid with epidermal covering.**

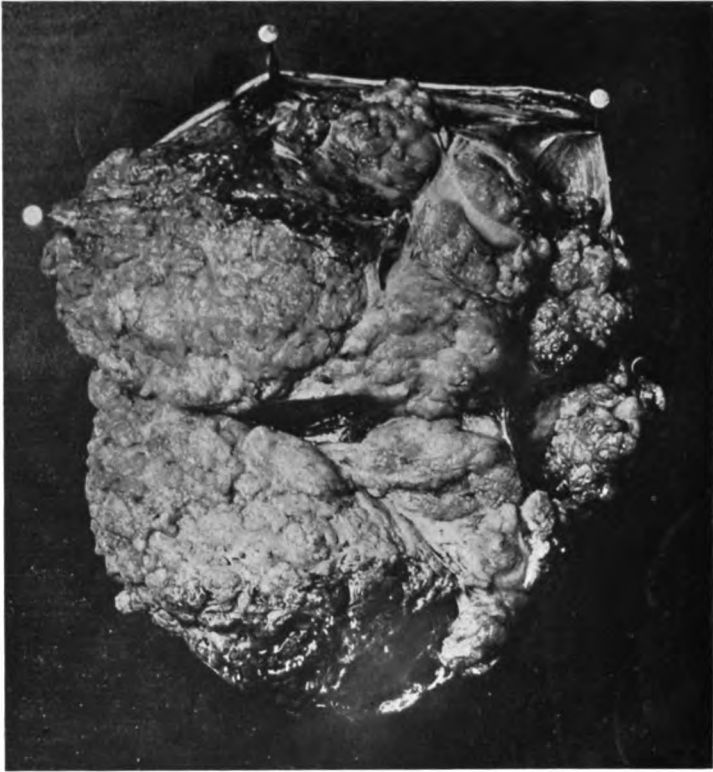
**FIG. 15.**



**Photomicrograph. Pure myxoma of bone.**

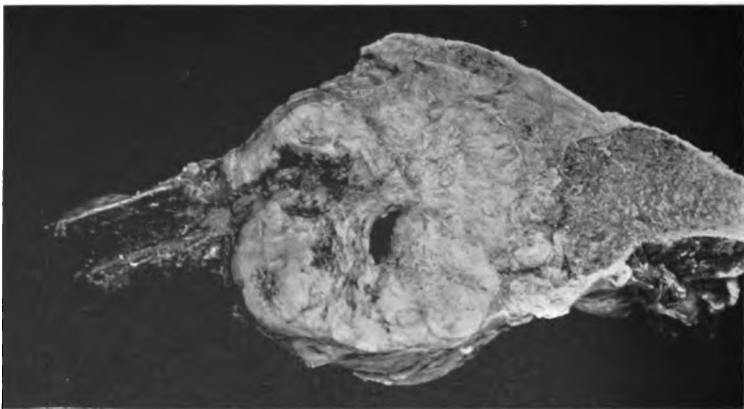


**FIG. 16.**



**Very large intracanalicular myxoma of the breast, with sarcomatous areas. Photograph of fresh specimen.**

**FIG. 18.**



**Spindle and round cell sarcoma of lower end of femur involving knee joint. Less malignant than the tumor in fig. 17. Photograph of sagittal section of fresh specimen.**

this observation is evidence of the relationship between bone cysts, osteitis fibrosa and giant-cell tumors. In this case it suggests a healing process in which the giant-cell tissue is being replaced by connective tissue. The giant-cell tumor, like the keloid, Fig. 14, and other forms of fibro-spindle-cell fibroma and sarcoma, must be looked upon as a pathological process on the border-line between true neoplasms and overgrowth of tissue of an inflammatory origin.

**MYXOMA OF BONE.**—Fig. 15 is a photomicrograph of a pure myxoma. This is a very rare tumor. I am inclined to think that Codman's observation of a medullary growth in the second phalanx of the middle finger (*Boston Med. & Surg. Jour.*, vol. cl, Febr. 25, 1904, p. 211) was a myxoma and not a bone cyst. My colleague Dr. Baer has recently sent to the laboratory tissues removed from a tumor identical in situation, X-ray and gross pathology, with Codman's case. Microscopically it is a pure myxoma.

These myxomatous tumors have a distinct relation to embryonic cartilage tumors and bone cysts. In the myxoma there is apparently a greater tendency to sarcomatous change. This is demonstrated in the intracanalicular myxoma of the breast, Fig. 16, and in the myxoma of nerve-sheaths. These myxomatous tumors when subjected to conservative operation frequently recur locally. The tumor is not often encapsulated, and I am of the opinion that it extends locally in such minute strands that it is not recognized at the operation.

**THE MORE MALIGNANT BONE TUMORS.**—Fig. 17 (Fig. 2, Plate I) gives the fresh appearance of a medullary growth of the lower end of the femur. In the X-ray its more malignant nature could be interpreted from the fact that without very great expansion of the cortical bone it had perforated this capsule and produced a popliteal tumor, a growth in the joint along the crucial ligaments and in the subquadriceps bursa. The patient was a female aged forty-five; the symptom of onset was intense pain referred to the knee six months ago; there was no swelling until three months ago. In the fresh specimen, at first sight, one might mistake this tumor for a giant-cell sarcoma (compare with Fig. 20, plate iii, *INTERNATIONAL CLINICS*, vol. i, Seventeenth Series, p. 272). It has, however, distinct differences. The little cystic cavities filled with blood and blood-stained serum I have never observed in the giant-cell tumor, but often in the perithelial angio-sarcoma. Microscopically this tumor is composed of spindle and round cells grouped about endothelium-lined tubules containing blood. Fig. 18 shows a more malignant spindle and round celled sarcoma of bone, sometimes curable by operation.

### Surgery of the Thyroid Gland

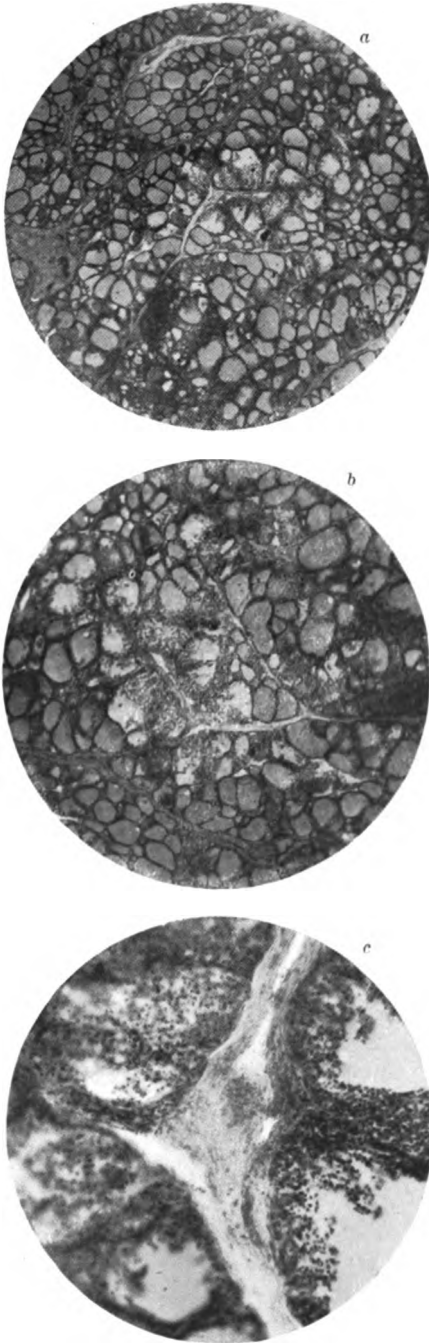
Interest in surgery of the thyroid gland has increased, especially as to exophthalmic goitre, the parathyroids and recurrent operations on simple goitre. The former was one of the subjects discussed before the general meeting of the American Medical Association (*Jour. of the Amer. Med. Ass.*, vol. xlix, Oct. 5 and 12, 1907). In these papers one will find the best recent contributions to the subject. The literature on the parathyroids has been unusually prolific during the last year, as shown by the collective review by Karl Schirmer (*Centralbl. f. d. Grenzgeb. d. Med. u. Chir.*, 1907, vol. x, p. 401) and Halsted and Evans (*Annals of Surg.*, October, 1907, vol. xlii, p. 489).

There appears to be no question that the early and partial removal of the thyroid gland gives the best results in patients exhibiting symptoms (thyreotoxic) of hyperthyroidism. The earlier this operation the better the immediate and permanent results. One should not delay until the typical picture of exophthalmic goitre is established, when the mortality of the operation is greater and the permanent results less satisfactory, and secondary operations become necessary with their danger of injury to the parathyroids. In patients suffering with nervousness, slight and intermittent tachycardia, the thyroid gland should be examined. The possibility of a hyperthyroidism with these slight symptoms and perhaps no palpable enlargement of the gland can usually be established by the administration of thyroid extract. If the symptoms are increased, the indications are that the thyroid is the source of the trouble, and partial removal is indicated. Many surgeons and physicians paying especial attention to the relation of the thyroid to the general condition of the patient are becoming more and more convinced that many conditions heretofore looked upon as mild grades of neurosis or hysteria, or functional lesions of the heart, are due to hyperthyroidism and can be relieved best by lobectomy. Kocher was one of the first to perform thyroidectomy for tachycardia, or, as Barker calls it, pycnocardia.

Although the experience of many surgeons is increasing in the finer technique of thyroidectomy and the preservation of the parathyroids, yet, it does not seem to me, that the operative mortality in the very grave cases has been decreased. This experience should be used as an argument in favor of earlier intervention.

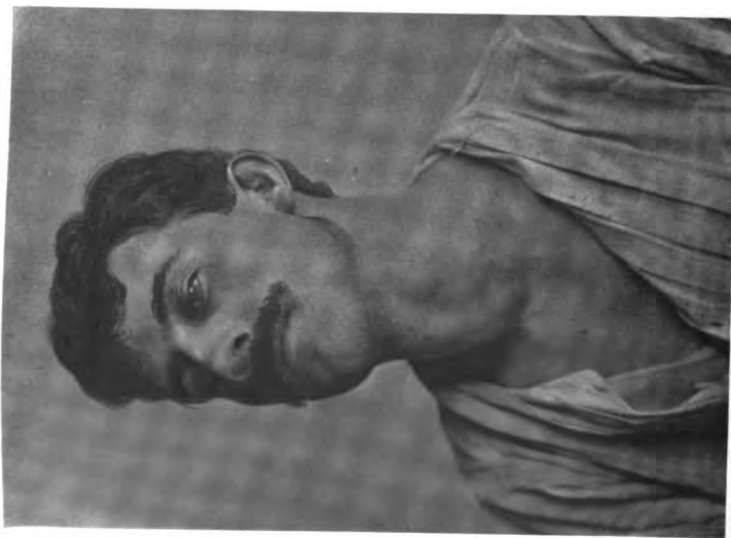
Recently I saw in the wards of St. Agnes Hospital a patient with an extensive ulceration in both groins and over the pubes secondary to the incision of chancroidal bubos. As he had been in the hospital a

**FIG. 19.**



**Focal areas of exophthalmic hypertrophy (a) low, (b) medium and (c) high powers.**

FIG. 20.



Photograph of patient with recurrent simple goitre.

FIG. 21.



Photograph of alcohol specimen. Larynx, trachea, thyroid gland in subternal thyroid tumor.

few days one could inspect the relation between the temperature and pulse chart. Although he had been quiet and in bed his pulse rate varied from 100 to 120, and there was no fever. The blood did not show a lymphocytosis mentioned by Kocher, which undoubtedly is a late sign of hyperthyroidism. This man's thyroid was distinctly but moderately enlarged. His symptom—tachycardia—was increased by small doses of thyroid extract. I looked upon the condition as an early hypertrophy of the thyroid secondary to a toxic thyroiditis. After an observation of about ten days during which there was no improvement, the right lobe was removed. In the gross there was not much evidence of hypertrophy, but microscopically the focal areas of this epithelial proliferation emphasized by MacCallum were present and are illustrated in Figs. 19a, 19b, and 19c.

When patients with simple goitre who were operated on some years ago return with enlargement of the remaining lobe and desire relief, we are brought face to face with the necessity of preserving the parathyroids, because until quite recently in the ordinary lobectomy especial care was not taken to preserve these bodies, and many of the specimens in the laboratory, of both simple and exophthalmic goitre, cysts and adenomas, show one or two parathyroids.

Fig. 20 illustrates such a case. At the operation I left a crescent-shaped piece of thyroid tissue, including the poles and the zone of tissue beneath, containing the area near which the parathyroids are situated. I did not ligate the thyroid vessels, but after separating the thyroid from the scar and trachea, divided the thyroid tissue with the Paquelin cautery. The bleeding was insignificant, a few vessels required ligation, but there was sufficient oozing to demand a gauze drain. This patient has had no symptoms of parathyreoprivia. I have employed this method successfully in three cases, none of them exophthalmic goitre.

Substernal struma is rare, but it may become a very critical lesion, due to pressure on the trachea in the superior mediastinum. Fig. 21 pictures the autopsy specimen and shows the small adenoma of the thyroid which had become wedged between the trachea and sternum. This patient, an adult woman, had observed in the middle line of the neck above the sternal notch, a movable tumor of five years' duration. She had suffered with attacks of dyspnoea for five days and was admitted to the hospital (Union Protestant Hospital) critically ill. Dr. Carr tells me that at first the thyroid tumor was not seen, but in the attempts at respiration now and then the tumor would appear a little above the sternal notch. Tracheotomy was performed and a catheter passed into

the trachea. The patient did not recover, although the obstruction to breathing seemed relieved. The examination of the autopsy specimen excludes the possibility of an intratracheal thyroid-tissue tumor. These have recently been collected by Meerwein (*Deutsche Zeitschr. f. Chir.*, 1907, vol. xci, p. 334).

### Surgery of the Breast

At the most recent meeting of the American Surgical Association (*Transactions*, vol. xxvi, 1907) a day was devoted to the discussion of the ultimate results after operation for carcinoma. The most complete records were from the Massachusetts General Hospital in Boston and from the Johns Hopkins Hospital in Baltimore. The prevailing opinion, it seemed to me, was one of discouragement. The relative number of cures after three years was not large, and late recurrences up to nine years were more frequent than the majority of the surgeons had heretofore thought possible.

Thanks to my association with Dr. Halsted and the opportunities at his clinic, I have been able to give this subject continuous attention since 1893, and I am convinced that our attitude should be hopeful. I can recollect distinctly at Agnew's last clinic at the University Hospital in Philadelphia in 1890, he stated that he had never cured a carcinoma of the breast. Agnew removed only the breast in a very rapid operation. He also knew what carcinoma meant, and had an unusually large experience with tumors of the breast. This statement can be taken as pretty good evidence that the restricted operation should never be selected for a malignant breast tumor. See Figs. 22a and 22b.

At that time (1890) there were but two surgeons in this country, to my knowledge, who were performing a very radical operation—Senn in Milwaukee and Halsted in Baltimore. The literature on this subject in this country deals more with modifications of technique, plastic in character, on skin and muscles, in order to allow a more complete closure of the wound and to improve the functional use of the arm.

I think such contributions are based on a narrow and incomplete conception of carcinoma and its modes of local infiltration, and a wrong notion as to the use of the arm after a complete operation.

In attacking carcinoma anywhere in the body the first plan in the operation should be as complete eradication as is anatomically possible, providing the mortality of the operation and insurance of a cure justify the mutilation. In carcinoma of the breast properly performed the mortality is insignificant (1 per cent.), the mutilation

**FIG. 22 a.**



**Local recurrence near scar (two nodules) after excision of the breast only for carcinoma. Photograph of tissue removed at the second operation.**

**FIG. 22 b.**



**Photograph of gross appearance of recurrent carcinoma shown in Fig. 22 a.**



**FIG. 23.**



**Ultimate result after complete Halsted operation with  
skin-grafting. (Patient of Dr. McGlannan.)**

slight and, in my experience, the functional use of the arm, if the clavicular bundle of the pectoralis major is left, sufficiently good for all practical purposes, and the increasing number of cures justifies the procedure.

I have just seen a patient of my own operated on three months ago who informs me that she is able to use one arm as well as the other. She earns her living washing and ironing. Fig. 23 was taken about six weeks after a complete operation with skin-grafting performed by Dr. McGlannan, my associate at St. Agnes' Hospital. It represents well the usual result after the most complete dissection with a large area of skin-grafting.

I am quite sure that Dr. Halsted and all his associates feel justified by the present results to continue the performance of the radical operation.

The ultimate results in Halsted's clinic bring out facts which, if properly interpreted, offer additional hope of increasing the numbers of permanently cured patients. If we divide all cases subjected to complete operation into three groups: no metastasis to the axilla, metastasis to the axilla, and metastasis both to the axilla and supra-clavicular glands, the per cent. of cures three years after operation is eighty-five, thirty-one, and ten per cent. respectively. If these cases are followed longer than three years the late recurrences reduce the per cent. of cures to seventy-five, twenty-four, and seven.

During the same period a few incomplete operations on very early carcinomas of the breast have been performed in the clinic, and I have specimens and records in the surgical pathological laboratory of a larger number received from outside sources. Among these there is but one cure; in this only four years have elapsed since the operation.

This evidence agrees with the statement of Agnew that restricted operations do not accomplish a cure.

It is my opinion that the failure to find cancer cells in the axillary glands does not positively exclude their presence.

These figures show that if a cancer of the breast is operated on sufficiently early before the axillary glands show metastasis with the microscope, the probability of a cure is at least seventy-five per cent.

When we study the ultimate results of those carcinomas in which, before operation, the tumor could not be recognized as malignant and into which an exploratory incision had to be made followed at once by the complete operation, the percentage of permanent cures is about eighty per cent. Again, when each pathological group of carcinoma is investigated as to the duration of the tumor before operation,

it is definitely proved that the shorter this time the greater the per cent. of permanent cures.

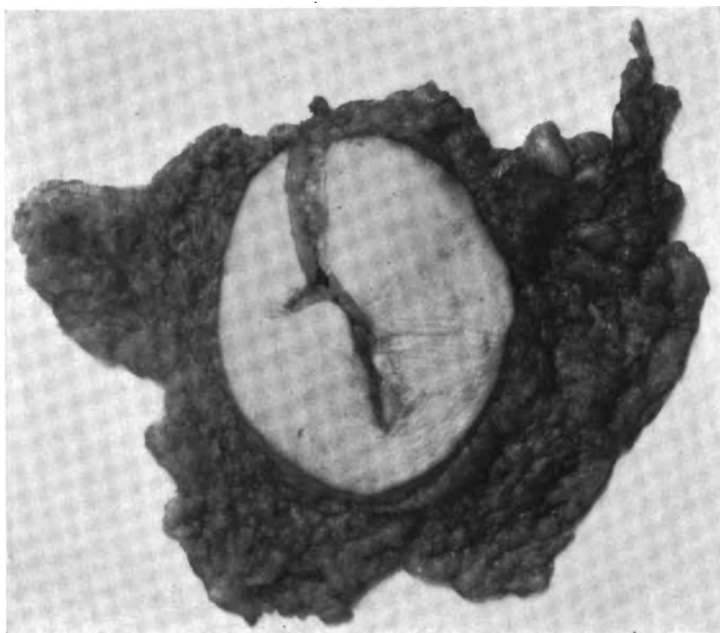
If the women of this country can be educated to seek advice the moment their attention is called to the breast by any unusual sign or a mass, and these patients are at once referred to the surgeon and all such tumors which prove to be malignant are eradicated by a complete dissection, I am quite confident that the percentage of permanent cures will be greatly increased.

Handley's painstaking work on the dissemination of mammary carcinoma (*Lancet*, April 8, 15, 22, 1905; and *Cancer of the Breast and its Operative Treatment*, London, 1907, W. Sampson) which is so fully discussed by Halsted (*Annals of Surgery*, July, 1907, vol. xlv, p. 1) may be looked upon as furnishing further evidence in favor of the complete operation. There is not space at this time to discuss Handley's recommendation of a restricted skin excision, and a much wider subcutaneous dissection. I cannot agree with him that in his method the subcutaneous dissection is greater than in Halsted's, Fig. 24, although this might be so interpreted from Halsted's publications. When one takes a wide area of skin, as is done in Halsted's operation, the further subcutaneous dissection does not appear as extensive as in Handley's method, where little skin is removed and the skin flaps dissected back for a relatively greater distance. Having only recent experience with Handley's method, I am not in a position to estimate if there be any danger of increasing recurrence by restricting the area of skin removed. However, this experience is sufficient to demonstrate that from the standpoint of rapid uncomplicated healing of the wound, excision of a larger area of skin, with immediate skin-grafting, gives better results. If a surgeon restricts the area of skin excised with the breast and the tumor, and then conscientiously dissects the skin back far enough to allow the proper subcutaneous dissection, the vitality of these flaps is always jeopardized, and some necrosis will follow. I have succeeded once in ten operations in obtaining perfect healing without necrosis.

**THE EARLY DIAGNOSIS OF CANCER OF THE BREAST.**—Fig. 25 illustrates the method of bringing out dimpling which may be looked upon as pathognomonic of carcinoma. If the breast about the tumor is grasped with both hands and pushed forward, dimpling, as shown in the photograph, will only be observed when the tumor is malignant. A benign tumor will bulge. See Fig. 26.

When the surgeon is unable, from the clinical history and examination to convince himself that the palpable mass in the breast is

**FIG. 24.**



**The tissues which are removed in the complete Halsted operation.**

**FIG. 25.**



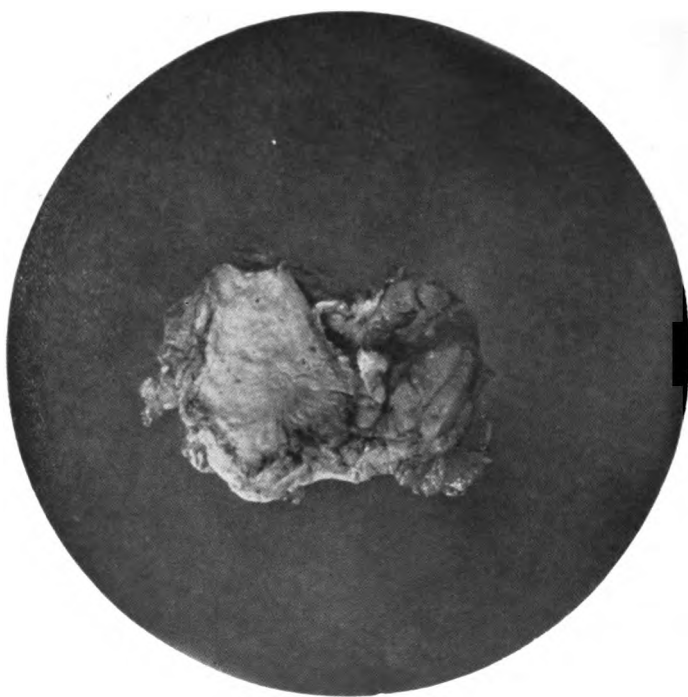
**Dimpling of the skin in early carcinoma of the breast and the method of demonstrating this sign.**

FIG. 26.



The bulging of the breast in doubtful and non-malignant tumors.

FIG. 27.



The gross appearance of carcinoma. Photograph of alcohol specimen.

not malignant, he must make an exploratory incision and differentiate the benign from the malignant either by its naked-eye appearance or a frozen section. I prefer the former. Fig. 27 is a photograph of a section of the alcohol specimen of a small tumor of the breast sent to me for diagnosis. It was looked upon by the operating surgeon as a fibroadenoma. Even in this photograph the solid tumor can be distinguished from the surrounding fat; it has no capsule; the little cavities represent minute areas from which granular material had been expressed, and the dots and lines represent similar areas still filled with the granular material. The absence of a capsule, the definite infiltration at the border, although the mass is somewhat circumscribed, and these granular dots and lines in a fibrous stroma should be recognized as the gross picture of cancer as readily as a properly stained microscopic section. I have recently discussed all these differential clinical and pathological points in diagnosis in the *American Journal of Medical Sciences* for February, 1908.

Fig. 28 (Frontispiece) illustrates the gross appearance of a medullary carcinoma half of which is hæmorrhagic. This tumor is of a relatively low grade of malignancy. Of the patients who were subjected to operation early, within the first few months after the appearance of the tumor, all have been cured. The patient from whom this tumor was removed had allowed it to grow for four years, and when subjected to operation the hæmorrhagic portion had ulcerated through the skin and formed a fungus, and there were definite metastatic nodules in the skin, fascia and axilla. The delay has reduced the probabilities of a cure to practically nil, because up to the present time I have never observed a permanent cure when skin nodules could be demonstrated before operation.

**CYSTS OF THE BREAST.**—The most common cyst which may be single or multiple occurs in the breasts of women at about the menopause, and apparently is the result of epithelial activity on part of the parenchyma, in which the stroma plays little or no part. This parenchymatous process has received considerable attention in the literature and various names: *chronic cystitic mastitis* by König, *cystitic disease of the breast* by Réclus, *cystadenoma* by Schimmelbusch, and *abnormal involution* by Warren. I have ventured to call it *senile parenchymatous hypertrophy* (*Surgery, Gynec. & Obstetrics*, Dec., 1906, vol. iii, p. 721, and the *Bulletin of the Johns Hopkins Hosp.*, April, 1907; *American Jour. of Med. Sciences*, February, 1908). Finney (Keen's *Surgery*, vol. iii, 1908, p. 568) gives a very good résumé of the clinical and pathological picture. All investigators have found two types:

in one, smooth-walled cysts of various sizes and numbers predominate. I have found that in this group carcinoma is rarely observed. For this reason conservative operations are justifiable—excision of one or more of the simple cysts. In the second type there are no large cysts, but the gross picture resembles that of the cystic adenoma, except that it is a diffuse and not a circumscribed area. The appearance has been pictured by Finney (*loc. cit.*, Fig. 330) and in my own contribution to *Surgery, Gynecology and Obstetrics*, both the gross and microscopic changes are fully illustrated. In this type the epithelial activity is enormous. The little cysts are filled with proliferating cells; it resembles somewhat the hypertrophy in lactation or exophthalmic goitre. In the observation of practically all investigators at least fifty per cent. of the cases have been associated with carcinoma. The breast should always be completely removed, and if there be any appearance or suspicion of carcinoma, the complete operation should be performed. Fig. 29 is a photomicrograph of a small tumor found in the breast near a simple cyst. It differs from the epithelial change in senile parenchymatous hypertrophy which I have called adenocystic, in that the majority of ducts and acini are lined by a single layer of cells, and there is considerable increase in the stroma. It represents the ordinary picture of a fibroadenoma. Fig. 30 pictures the histologic appearance of the dilated duct. This dilatation of the ducts is always found in senile parenchymatous hypertrophy and is most marked in the cystic type. The contents of the duct is a thick, greenish or brownish, grumous material and can be expressed like paint from a tube. It is not a sign of carcinoma.

**SARCOMA OF THE BREAST.**—The fibroepithelial tumor in which hypertrophy of the intracellular myxomatous stroma predominates—the so-called intracanalicular myxoma—usually, when it has reached such a size that it involves one-half or more of the breast, has become a sarcoma. These tumors, although from the history and examination have the appearance of benignity, should always be treated as sarcoma. An area of skin, the entire breast, a wider zone of subcutaneous tissue and the pectoral muscle should be removed in one piece. When this is not done and the tumor proves to be a sarcoma there will be recurrence in the pectoral fascia. Fig. 16 is a photograph of the alcohol specimen of such a large intracanalicular myxoma.

### Surgery of the Joints

**BURSITIS.**—Fig. 31 illustrates the characteristic asymmetry of the scapula in subdeltoid bursitis (Codman's disease). Note that when

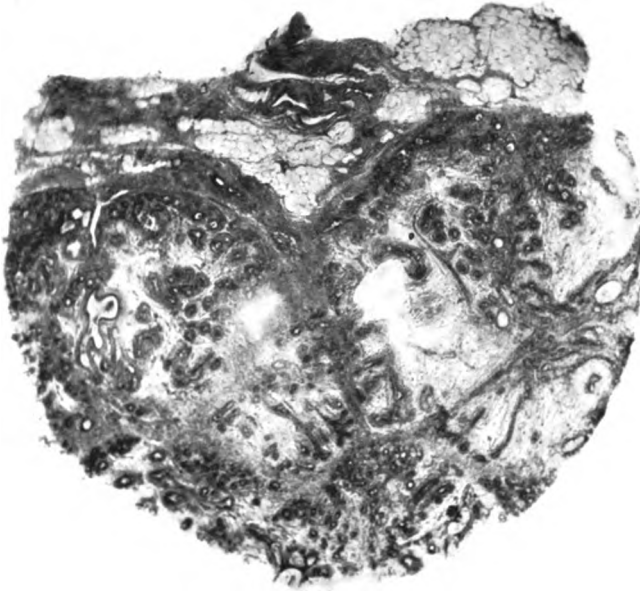


FIG. 29.—Small fibroadenoma near a simple cyst of the breast. Photomicrograph. (Schapiro.)

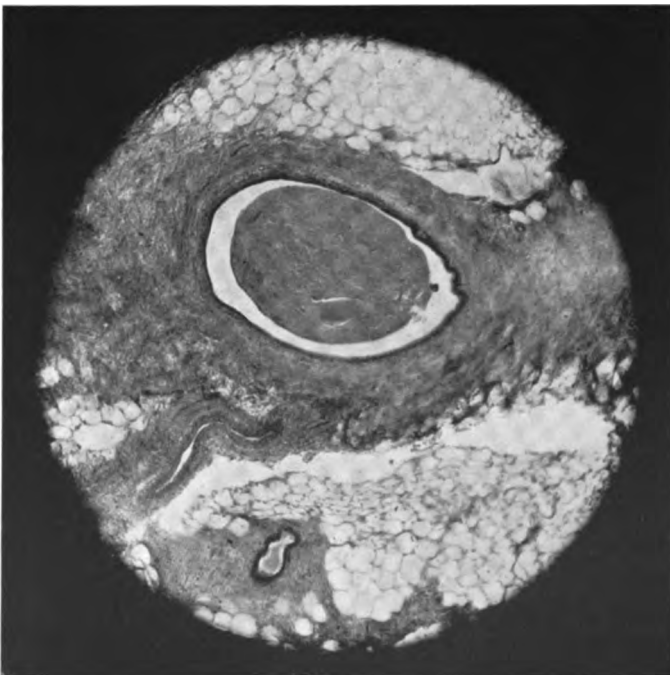


FIG. 30.—Photomicrograph of dilated duct in senile parenchymatous hypertrophy. (Schapiro.)

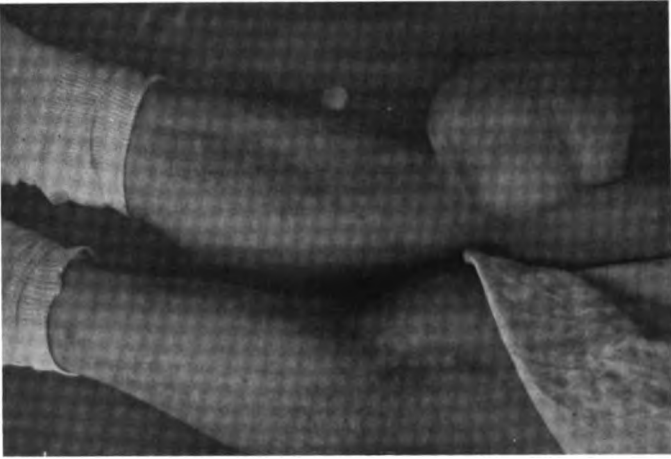


**FIG. 31.**



**Photograph of patient to illustrate the fixation of the scapula in subdeltoid bursitis.**

FIG. 32.



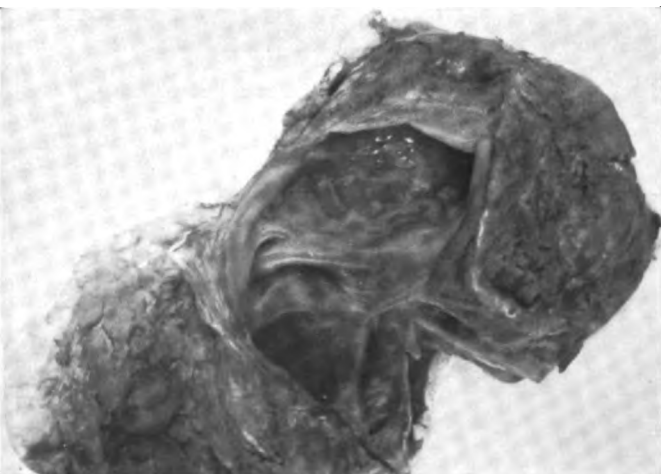
Photograph of patient with chronic buritis: prepatellar tumor present eight years.

FIG. 33.



Surface appearance of buria in fig. 32.

FIG. 34.



Portion of the buria with smooth wall in fig. 32.

FIG. 35.



Arthritis deformans due to gonorrhœal infection.

both arms are elevated the scapula on the affected side moves with the arm. In this case the lesion was of but four weeks' duration, subacute, and was relieved by passive motion and massage.

Codman was the first to call special attention to this and describe and illustrate its anatomy and pathology. In his first paper (*Boston Med. & Surg. Jour.*, May 31, 1906, vol. cliv, p. 613) Codman recommended breaking up of the adhesions under ether and the temporary fixation of the arm in the splint in extension and abduction. Baer (*Johns Hopkins Hospital Bull.*), in a more recent report, believes that results are more quickly accomplished by the excision of the bursa.

This bursitis has, until Codman's paper, presented a clinical picture usually misinterpreted. The patients had been treated on the supposition that it was some form of arthritis or nerve injury. This fact was demonstrated in a somewhat amusing way in a large surgical clinic some years ago. Dr. Codman and myself had both been invited to present papers before the Academy of Medicine in the city in which this clinic was situated. He had written and telegraphed asking for some cases to illustrate his paper on subdeltoid bursitis, with the answer that none could be found. He arrived fortunately early in the day, went to the dispensary, and found four cases under treatment in the out-patient department on the diagnosis of synovitis or neuritis.

The inflammatory and neoplastic lesions of the bursa are apparently identical with those of the synovial membrane of joints, but are comparatively less frequent. On account of the superficial position of most bursæ the lesions are not so difficult to differentiate and, due to the fact that the bursa may be completely excised without harm, the treatment is much more simple.

Fig. 32 represents a huge prepatellar bursitis. It is of interest chiefly on account of its surface appearance shown in Fig. 33. As a rule, in bursitis, the inner surface is smooth and there is a connective-tissue wall, Fig. 34. But in this case there are numerous septa, cord-like bands and definite roundish tumors. The bursa contained a bloody fluid and the surface of the bursa, especially that over the tumors, was very hæmorrhagic. At first sight it looked like an angioma and for practical purposes it is an angioma, but microscopically these tumor formations are composed of very vascular organized exudate, very much like a villous arthritis. König has called attention to the organization of the exudate, layer by layer, in arthritis, and in some cases to its extreme vascularity. This seems to be a peculiar characteristic of the synovial membrane of joints and bursæ.

The tumor in the case just illustrated had been present eight years.

Benign angiomas of the bursa have been observed and also sarcomas. Martina (*Deutsche Zeitschr. f. Chir.*, 1906, vol. lxxxiii, p. 317) has published a contribution on tumors of the bursa.

**ARTHRITIS.**—There has been a great advance in the last few years in the recognition of the etiological factors behind the more obscure mono- and polyarthritides, and in the conservative and operative treatment. The comparatively largest group frequently collected under the name of arthritis deformans is being subdivided according to the etiological factors. Arthritis deformans is a term which should be confined to describe the characteristic clinical picture of a mono- or polyarticular inflammation which results in partial or complete ankylosis with deformity. Various etiological factors may produce this end result, and recent investigation has proved that the gonorrhoeal polyarthritis may follow a very chronic course and result in a definite arthritis deformans. In the last year I had three positive illustrations of this fact. Fig. 35 shows the characteristic changes in the hands and wrists in such a case.

#### Surgery of the Abdomen

**INCISION.**—The decision as to the place of the incision depends upon the ability to recognize the location of the primary lesion. In some cases this is difficult or impossible. Here the abdomen should be opened in the middle line below the umbilicus. This exposure allows a more general investigation than any other. In a recent case in which the diagnosis rested between acute pancreatitis and appendicitis I found, the moment I opened the abdomen, the omentum studded with fat necroses—a pathognomonic sign of pancreatitis. When I explored the pancreas through the proper and higher incision evidence of the disease was not encountered until the pancreas was exposed. Had I made this incision first, there would have been the dilemma as to the nature of the trouble for a longer period of time. In a second observation the clinical picture suggested an impacted gall-stone in the common duct, or an acute pancreatitis, but there were symptoms in the lower abdomen (hypogastric dulness) which did not fit well with this diagnosis. The exploratory incision immediately exposed the blood-stained fluid which is present in either pancreatitis or intestinal obstruction. Now the gangrenous loop due to a mesenteric thrombosis came into view.

This exploratory incision between the recti below the umbilicus is not only the quickest route, but of all others allows a more extended view and should be employed in all doubtful cases.

Incisions are selected in those regions in which the muscles can be separated. The object of this is to allow a better closure of the wound to prevent subsequent herniæ. There is nothing especially new of the so-called grid-iron or muscle-splitting operation, except its more general adoption and the employment of catgut as a continuous suture for closure. Blumberg (*Zentralbl. f. Chir.*, 1907, vol. xxxiv, Supplement No. 31, p. 51) in his recent discussion before the last German Congress of Surgeons makes one new suggestion that may prove of value. When the subcutaneous fat is very thick he excises a wedge-shaped piece. This, he claims, allows a better exposure with a smaller skin incision and removes part of that tissue (fat) which, we know, makes perfect healing more difficult. If there is much fat between the fascia or muscle he also removes it. This procedure has frequently been performed in the past in hernia, when the preperitoneal fat has been abundant.

Transverse incisions with division of muscle are sometimes indicated in laparotomies in order to enlarge the wound, expose certain viscera difficult of access, and for drainage. This subject is considered by Rockey (*New York Med. Record*, Nov. 11, 1905). In my own experience division of muscle is seldom necessary, but when indicated clinical and experimental experience demonstrates its justification and feasibility. In closing the wound the muscle should be accurately approximated with catgut. In witnessing Carrell's experimental work on dogs in the Rockefeller Institute, one cannot but be impressed with the splendid exposure through a transverse incision in the abdominal wall, and with the equally good healing after proper suture. If possible one should not drain through muscles cut across. They retract and leave a large gap.

**DRAINAGE.**—In all abdominal lesions the first question to answer is, should drainage be employed? Second, how can it be accomplished to meet the indications best? Neither question has been absolutely settled. In case of doubt, drainage should be employed. Coffey (*Jour. Amer. Med. Ass.*, March 16, 1907) stimulated by the work of Clark (*Jour. of Obst. and Dis. of Women and Children*, April and May, 1897 and *Johns Hopkins Hospital Reports*, vol. vii, 1899) and Yates (*Surgery, Gynec., and Obst.*, December, 1905, p. 473), did some very interesting experimental work. From a plaster cast of the abdominal cavity from which the viscera had been removed he constructed a model illustrating the chief recesses of the abdomen—the pelvis and the two flanks. Chrobak (*Zentralbl. f. Chir.*, 1907, xxxiv, p. 238) presents the more recent German view of the subject.

It is impossible in a short space to do more than mention the most important factors. Abdominal surgery has been advanced by improved methods in protection of the abdominal cavity during operation by gauze, pads and proper drainage after operation.

In the early years drainage was employed as a routine procedure, chiefly in pelvic work. Experience demonstrated that unnecessary drainage had its dangers. In the reaction against drainage mistakes in judgment were made on the side of closing wounds which should have been drained.

Up to the present time our methods of drainage are limited, and this fact must be emphasized. Only a small portion of the abdominal cavity can be drained. Within a few hours this relatively small area is shut off from the general abdominal cavity by adhesions.

In the treatment of abdominal lesions we must remember that drainage is not confined to the peritoneal cavity only. Enterostomy, gastrostomy, cholecystostomy are methods of drainage and have their distinct indications.

In intestinal suture we do not drain, because some soiling has taken place during the resection or anastomosis. If there is any doubt as to the security of the suture, or as to the circulation of the intestine near the suture, this area should be isolated by gauze drainage from the peritoneal cavity. Now, if a perforation takes place it will be walled off from the general peritoneal cavity and result only in a fecal fistula which usually heals spontaneously.

When considerable soiling has taken place from the lumen of the intestine, or from the infected tissue subjected to operation against loose fat or connective tissue which cannot be covered readily with uninjured peritoneum, this area should be drained. It is seldom necessary to drain any space completely covered with uninjured peritoneum. When the peritoneum is covered by a fibrinous exudate and this is soiled and cannot be completely removed, drainage is indicated. Whenever the lesion has produced granulation tissue which cannot be excised, drainage is indicated. Doubtful suture, questionable circulation, soiled tissue naked of peritoneum, fibrinous and granulation-tissue areas should be drained. Neglect of this precaution not infrequently leads to a fatal peritonitis.

The objections to proper drainage are the increased danger of post-operative obstruction and hernia. I cannot agree with Clark in his older paper that drainage is ever a factor in increasing the danger of post-operative peritonitis, provided this drainage is properly employed.

PLATE I

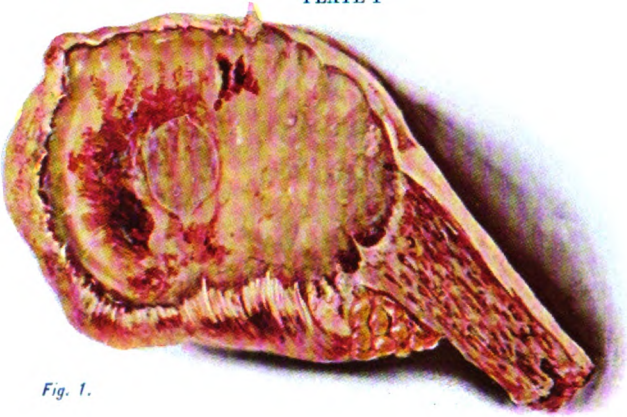


Fig. 1.

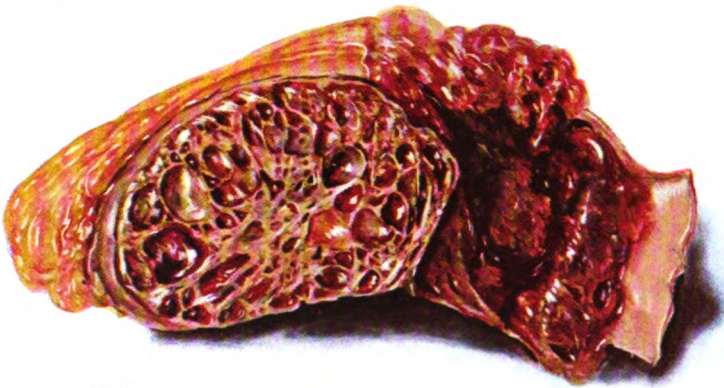


Fig. 2.



Fig. 3.

FIG. 1—(FIG. 8.) Multiple myeloma. Tumor in medullary cavity of outer third of clavicle. Painting of fresh specimen by Miss Hayes. This patient when first observed had but a single lesion, but the urine contained the Benze-Jones bodies.

FIG. 2—(FIG. 17.) Vascular, spindle and round celled sarcoma, medullary cavity of lower end of femur with piece of injected synovial membrane and cartilage of knee joint. Painting of fresh specimen by Miss Hayes.

FIG. 3—(FIG. 53.) Hypernephroma of kidney, section through tumor and part of kidney. Painting of fresh specimen by Miss Hayes.





In posterior gastroenterostomy, or Finney's gastroduodenostomy drainage is never indicated. If there is much scar tissue at the pylorus which would jeopardize the security of the suture in Finney's operation, pylorectomy or posterior gastroenterostomy should be selected. In gastrectomy, drainage should be employed if during the operation the pancreas is injured. Leakage of pancreatic juice disseminates trypsin with the resultant acute pancreatitis, fat necrosis and general toxæmia. It is very difficult to prevent this by suture.

In operations upon the gall-bladder and its ducts one or the other should be drained, with rare exceptions. The object of this drainage is not its effect upon the peritoneal cavity, but to allow a temporary exit of bile. Experience has shown that this has a distinct beneficial effect. Ideal cholecystotomy with removal of the stones in the gall-bladder and followed by suture and closure of the wound cannot be compared, in results, with cholecystostomy. The same is true with regard to stone in the common duct. Gauze is placed around the tube to protect the peritoneal cavity from the leakage of bile. This wall of gauze should be greater in those cases in which the clinical history of the case and the appearance of the bile indicate unusual contamination.

In acute hæmorrhagic pancreatitis, when the abdomen is opened and the blood-stained fluid evacuated, the chief factor of the toxæmia is removed, but gauze drainage to the affected pancreas is indicated to prevent further leakage of its secretion and to establish a portal of exit should necrosis and suppuration follow. In pancreatic abscess, as in any other abdominal abscess, drainage is employed for two purposes: one, to allow an easy exit for the further purulent secretion from the abscess wall, and, the other, to protect the general peritoneal cavity from this infected area and its new outlet. In all abscesses which are opened through the peritoneal cavity these two factors of drainage must be recognized and provided for. When one expects considerable discharge a tube should be employed with or without gauze to carry away the secretion.

The decision when and how to drain is most difficult in appendicitis, and this I will discuss later.

When drainage is employed it should be so placed that it answers the requirements for the rapid evacuation of the secretion from the infected tissue left behind, the certain protection of the peritoneal cavity, and adds as little as possible to the danger of post-operative obstruction. For the protection of the peritoneal cavity gauze answers the purpose best. This has been demonstrated experimentally and

clinically. In placing this gauze it should never lie between loops of intestine. It should be sufficient in quantity not to be influenced by peristalsis. There is less danger from a large drain than from a small one. Gauze is not the best material to carry away secretion. One should either use a tube, glass or rubber, or protective. The so-called cigarette or stogie is composed of a thin roll of gauze covered with protective (rubber tissue). These drains should always be surrounded by gauze. The secretion finds the outlet of least resistance along the rubber tissue and, in addition, these drains can be removed early, leaving the protective wall of gauze.

**MULTIPLE DRAINAGE.**—In some cases it may be necessary to drain through more than one incision, Fig. 36. This may be indicated by multiple abscesses. In general peritonitis from appendicitis and intestinal perforation the purulent exudate gravitates into the pelvis and sometimes into the flanks. This infected exudate excites a peritonitis in which, after a few hours, the peritoneum is changed and covered with organized fibrin. Such an area will continue to secrete, and if not drained will be the further factor in keeping up the general peritonitis, or forming a local abscess. Such a form of local peritonitis should be drained. In the pelvis, in women, it is best accomplished through a vaginal puncture; in men and children, through a suprapubic incision. The possibilities of this localized peritonitis in the pelvis and flanks must be borne in mind, especially when the lesion is in the upper abdomen, and these areas are not exposed during the operation. The selection of cases for this more extensive drainage undoubtedly has decreased the mortality of the so-called general peritonitis.

Last July, in opening the abdomen of a patient with typhoid fever and symptoms of perforation of about eight hours' duration, I found the perforation in the pelvis. The upper abdomen contained but cloudy serum, but the pelvis was filled with fæces and a purulent exudate. The peritoneal surfaces were covered in patches with a dirty-gray exudate. After closing the peritoneal cavity and pelvis and fixing the intestine containing the closed perforation to the upper portion of the mid-abdominal wound for a later enterostomy if indicated, I felt convinced that there would be further exudate from the pelvis, and for this reason I drained. Subsequent events demonstrated so much purulent secretion from the drain that I am quite certain that the patient would have died of peritonitis or developed a pelvic abscess, had drainage been omitted.

**STOMACH AND DUODENUM.**—With the exception of gastroptosis

**FIG. 36.**



**Photograph of patient to illustrate multiple drainage of the peritoneal cavity in appendicitis and general purulent peritonitis. The patient recovered.**



future progress in the surgery of the stomach and duodenum will depend more on diagnosis and early intervention than on improved technique. It has required years and a large experience to establish the indications and contraindications for gastroenterostomy, and its technique. Partial or complete gastrectomy or pylorectomy is not a difficult operation.

The problem of diagnosis still offers much for investigation. At the present time it seems impossible, except in a general way, to select the smaller group for which surgical intervention is indicated. The majority of patients suffering with so-called gastric symptoms have no organic lesion. The symptoms are usually due to disturbance of the nervous mechanism and are part of the complex picture of some form of a neurosis. In others, the symptoms referred to the stomach are due to organic lesions of viscera near, or remote from, the stomach; for example, cardiac, nephritic and hepatic. In some organic lesions of the stomach, for example, simple or acute gastric ulcer, medical treatment should first be employed. In carcinoma early operation with complete excision is the only hope. In pyloric obstruction surgery is the only means of treatment.

Now that we know so much more about what surgical intervention can do and now that we have established a technique with a mortality which hardly needs consideration in the decision as to operation, the question is, how to select the cases. From my own experience and from a very careful study of the literature, I cannot but conclude that at the present time we must acknowledge with our medical colleagues, or perhaps force them to acknowledge with us, that exploratory laparotomy is the only accurate method.

Cancer of the stomach has been cured, but the relative number of cases is small. In every patient at the cancer age, with gastric symptoms, the possibility of a malignant lesion should first receive attention and unless this can be absolutely excluded, the stomach should be inspected. In the operable stage, with few exceptions, cancer of the stomach exhibits no differential signs.

Exploration of the upper portion of the abdomen in doubtful cases (most cases are doubtful when subjected to early operation) throws upon the surgeon a new responsibility—the ability to differentiate, first, two great groups. One, in which the findings are negative. Here he must have the courage of his convictions and close the wound without further interference. Second, in which there is a lesion. Now, the proper method of operation for its relief must be selected and employed.

To exclude any organic lesion requires a painstaking examination

not only of the stomach and the viscera about its pylorus, but of other abdominal organs. I have explored the abdomen of a patient at the cancer age who complained of nothing, but epigastric pain and belching, of two months' duration. Nothing could be made out on examination before operation. I was about to close the abdomen after a futile search when a bystander asked me to illustrate the proper position of the jejunum in posterior gastroenterostomy. In pulling the transverse colon out of the incision to do this, I exposed the splenic flexure which I must have missed, for here was a small carcinoma, ring-shaped, not thicker than the index finger. There was nothing clinically to suggest this lesion. Last fall a patient was shown before the Clinical Society of Surgery in New York, with symptoms all referred to the gall-bladder area. On exposing the gall-bladder nothing was found. The appendix was then exposed. This organ was cystic and adherent in the pelvis. Pelvic organic lesions may exhibit only epigastric symptoms, while on the other hand, gastric lesions like ulcer, may be associated with symptoms referred to the pelvis only. Friedenwald whose experience with gastric lesions is unusually great, referred a patient to a gynecologist for pelvic trouble. There was nothing in the history or examination to suggest to Friedenwald gastric ulcer. Yet, at the exploration there was nothing in the pelvis, but in the wall of the stomach near the lesser curvature an indurated gastric ulcer (*INTERNATIONAL CLINICS*, April, 1907, vol. i, Seventeenth Series, p. 282, Fig. 26).

When an induration is found in the wall of the stomach, can the question, whether it be due to cancer or ulcer, be definitely settled? There has been much written on this subject in favor of the possibility that it can be done. Nevertheless, in the literature and from personal communications, practically every surgeon has performed gastrectomy for an indurated tumor on the diagnosis of cancer and found it to be ulcer, and, fortunately less frequently, the reverse—gastroenterostomy has been performed for ulcer which subsequent events proved to be cancer.

At the present time we must acknowledge that exploratory laparotomy may be necessary in a certain number of cases for diagnostic purposes, and that gastrectomy should be performed for all operable indurated tumors of the gastric wall, because ulcer cannot be differentiated from cancer.

**GASTRIC ULCER.**—In the recent meeting of the Congress of American Physicians and Surgeons there were two subjects discussed at the general meeting. One, on the relative value of laboratory and clinical methods of diagnosis; the other, on the comparative value of the

medical and surgical treatment of ulcer of the stomach. In the former nothing was said as to exploratory incision as a method of diagnosis. In the papers on the latter subject it is demonstrated that the profession is more emphatic than ever before as to the surgical indications and limitations. Gastroenterostomy should be done only for obstruction, and then only in those cases in which the obstruction cannot be relieved by interference in the region of the pylorus. For indurated ulcer not in the region of the pylorus, and therefore not producing obstruction—resection is the operation of choice. There is no doubt that the indurated ulcer of the stomach and duodenum will entirely disappear in a certain number of cases. This has been demonstrated at secondary operations after gastroenterostomy. It is quite possible, if the ulcer is situated in a position in which it does not produce obstruction, that it may disappear under medical treatment. Fig. 37 is made from a sketch of a callous ulcer of the duodenum treated by posterior gastroenterostomy in September, 1906. During the same month a second case was subjected to operation. In both the ulcers occupied about the same positions and were of about the same size. They were situated in the superior and anterior wall of the duodenum just beyond the orifice of the common bile duct. In neither were the symptoms of obstruction marked, nor was there much dilatation of the stomach. In the one from which the illustration was taken posterior gastroenterostomy was done, in the other, as the gall-bladder contained gall-stones, only cholecystostomy was performed. As to the ultimate result both patients are apparently well.

**GASTROENTEROSTOMY.**—It is interesting to note that in the refinement of the technique of the short-loop operation there is still, apparently, a certain difference of opinion as to the proper line of incision in the jejunum and stomach. Wm. J. Mayo has just published his latest contribution on this subject with illustrations, Figs. 38, 39 and 40 (*Annals of Surgery*, January, 1908, vol. xlvii, p. 1). His lines differ somewhat from those employed by Moynihan. I have witnessed a number of posterior gastroenterostomies by surgeons of large experience and have been impressed that the exactness as to these lines is by no means always accomplished, yet, apparently the results are the same. For this reason I am somewhat sceptical as to the absolute necessity of this refinement of technique.

**GASTRIC CARCINOMA.**—Fig. 41 (Fig. 2, Plate II) shows the usual appearance of a carcinomatous ulcer of the stomach. The elevated border over which the mucous membrane of the stomach extends and then dips down is pictured. I reproduce this picture in order to discuss the



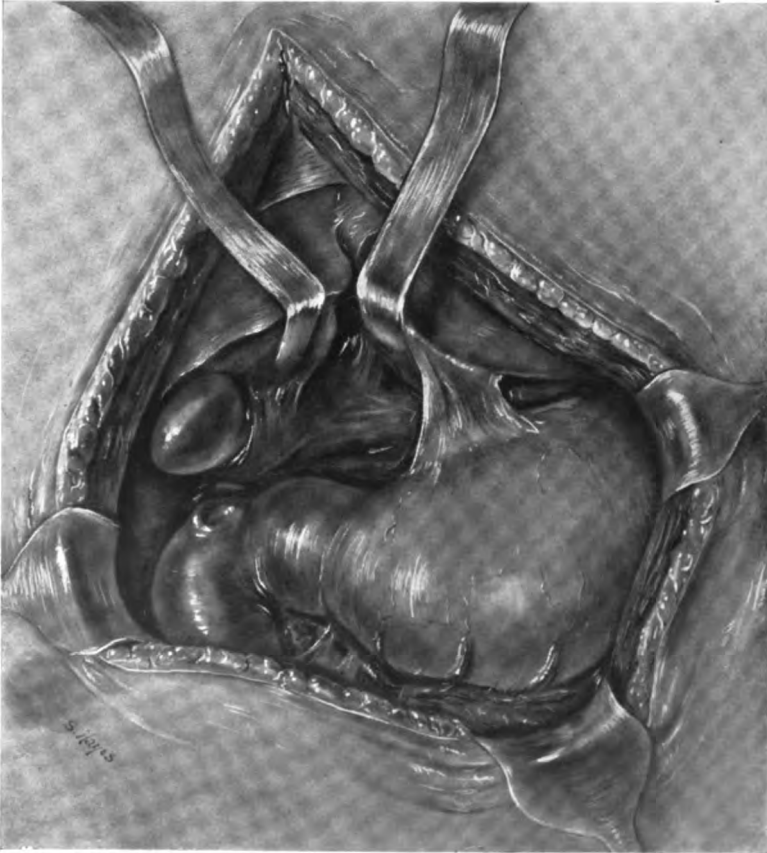
question of the origin of cancer in gastric ulcer. The majority of authorities are of the opinion that a large per cent. of carcinomata develop secondarily in ulcer. For this they bring forward clinical and pathologic evidence. There is no doubt that in many patients operated upon for gastric cancer there has been a long history of gastric disturbances which might be interpreted as an indication of ulcer. However, when we come to the pathological proof, I think it is lacking. I have compared gastric carcinoma with similar growths of the colon and rectum. Macroscopically and microscopically they are alike. If this is correct similar conclusions might be made that the latter also develop in old ulcers of the colon and rectum. I do not for a moment contend that gastric cancer cannot develop in ulcer, because we know that in every ulcer of the skin or mucous membrane there is a possibility of malignant epithelial growth. But, I do not feel that we are justified in stating that we can prove this by the examination of the growth.

**GALL-BLADDER AND DUCTS.**—The most important problem at the present time in the surgery of the gall-bladder is the proper selection of cases for cholecystectomy first, because of the inflammatory changes in the gall-bladder which have reached such a stage that the removal of the organ will give greater permanent relief than cholecystostomy; second, on account of the fact that in many of these chronically inflamed gall-bladders carcinoma is present. The Mayos in reporting cases from their clinic state that on three occasions the microscopical examination of the wall of the gall-bladders removed for its thickened condition revealed carcinoma. Two of these cases have apparently been cured. I have been unable to find in the literature a cured case of carcinoma of the gall-bladder in which the diagnosis was made at the operation. In two cases operated on in Halsted's clinic I was able to demonstrate, but only with the microscope, the presence of carcinoma. Fig. 42 shows a chronically inflamed gall-bladder of such a character that it could not be differentiated from the two cases in which the microscope revealed cancer.

It is my opinion that the chief indication for cholecystectomy at the present time is to get out chronically inflamed gall-bladders in which there may be a possibility of carcinoma. In no other way can the patients suffering with malignant disease be cured, and fortunately it is the best treatment for those in whom the chronic inflammatory process is not yet associated with carcinoma.

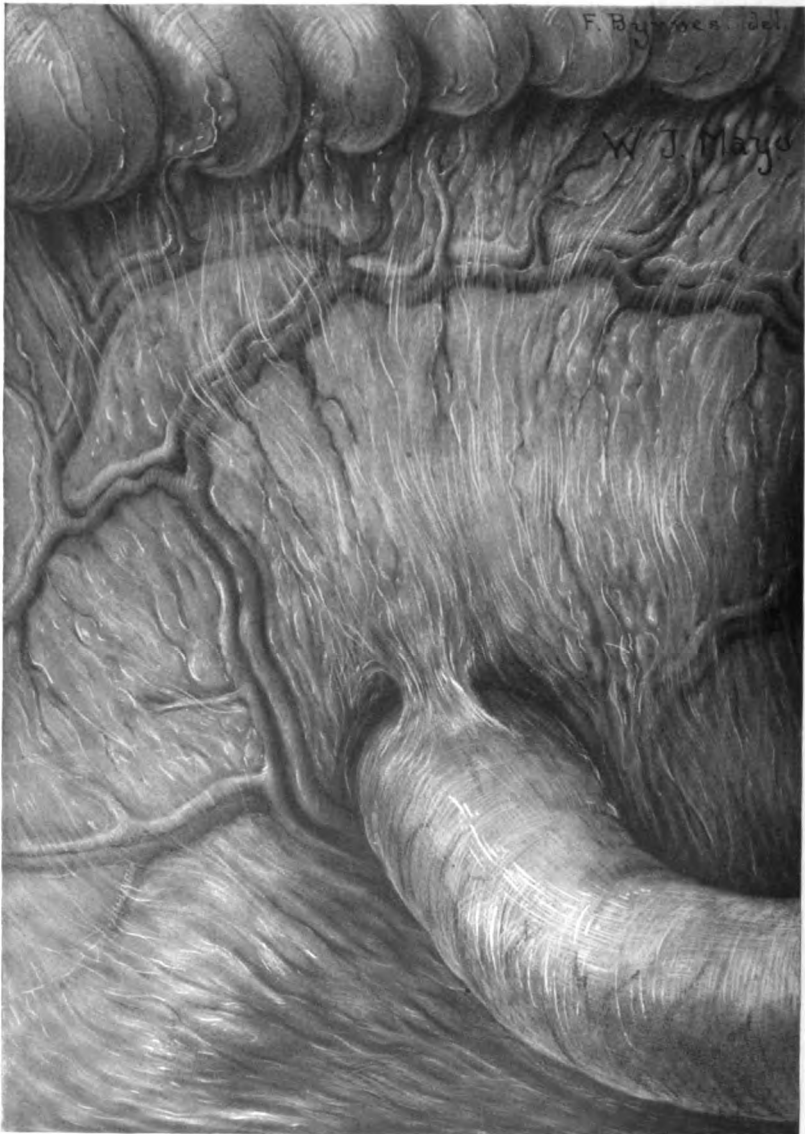
Fig. 43 illustrates the only example I have of complete sloughing of the mucous membrane of the gall-bladder. The tissue was sent to me by Dr. Casey of Rochester, N. Y. Clinically the symptoms were

**FIG. 37.**



**The appearance of a callous duodenal ulcer at laparotomy.**

**FIG. 38.**



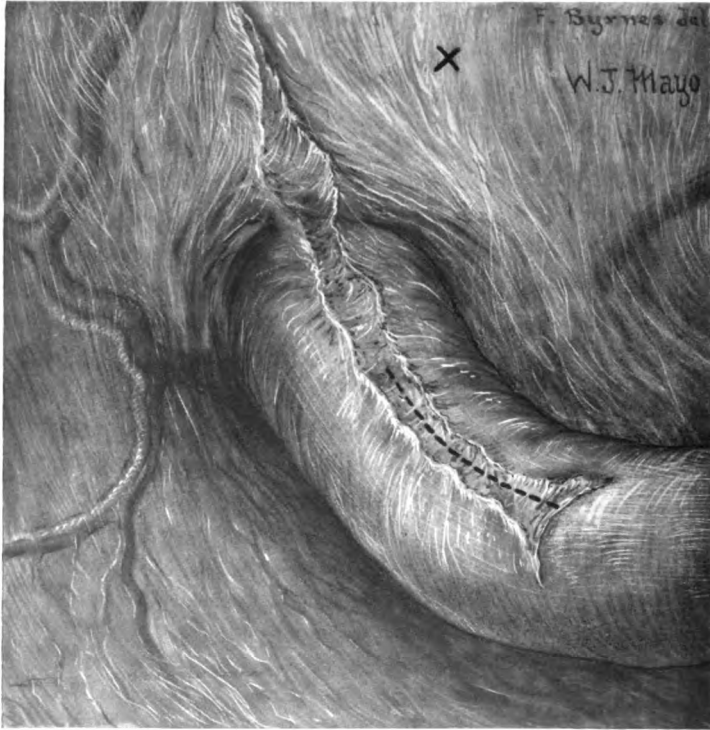
Showing small peritoneal fold, with intestine passing to the left. Normal form. (W. J. Mayo.)

FIG. 39.



Showing extensive peritoneal fold which turns the intestine to the right. (W. J. Mayo.)

FIG. 40.



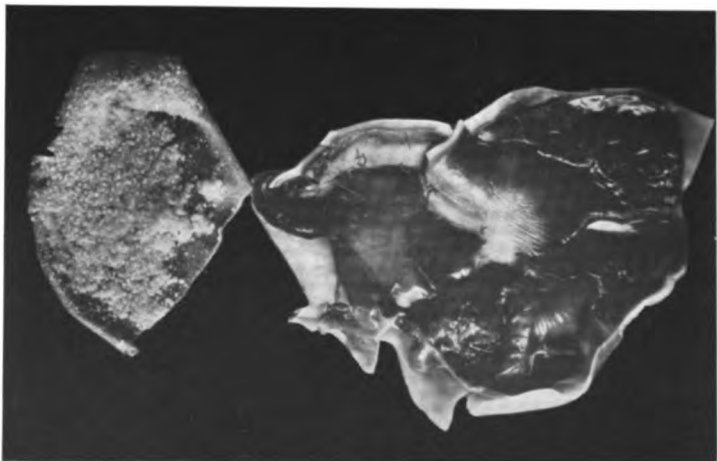
Shows the peritoneal fold separated. Dotted line shows proper situation for a no-loop gastro-enterostomy. X marks the point in the transverse mesocolon, where the stomach is to be brought out. (W. J. Mayo.)

FIG. 42.



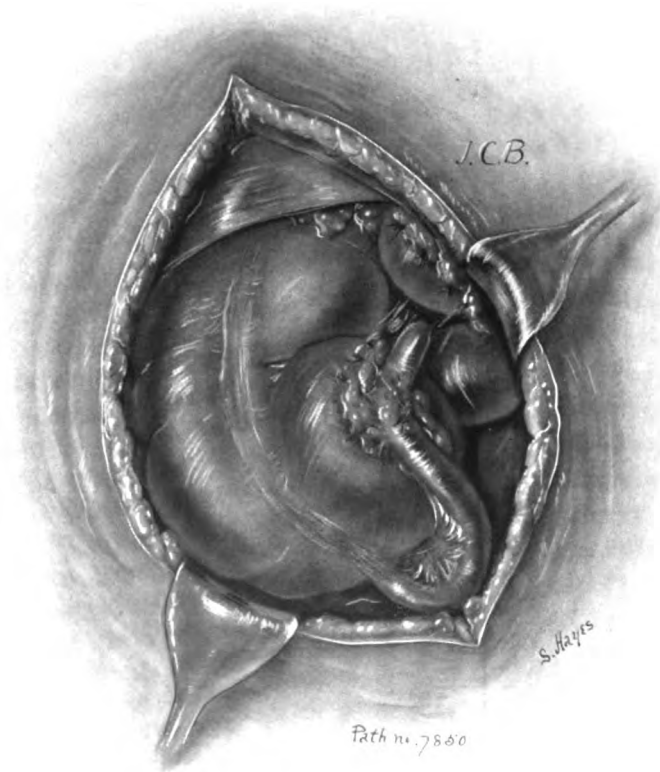
Chronically inflamed and thickened gall bladder, with perforation in which carcinoma can only be excluded by microscopic study. View of mucous membrane surface.

FIG. 43.



Photograph of a complete slough of mucous membrane of the gall bladder, associated with hydroph.

FIG. 44-a.



Chronic appendicitis with perforation of the tip of the appendix in the caecum. Made from sketch of findings at operation.

chronic; at the operation there was a distinct hydrops of the gall-bladder; after removing a large quantity of clear fluid this tissue came away; it is not noted whether any stones were found. In one of the pieces the epithelial portion of the mucous membrane seems preserved.

**APPENDICITIS.**—From my own experience and the literature it appears to me that there are three important problems which afford opportunity for further investigation: the minimum of symptoms which justify opening the abdomen in acute cases and the operation between questionable attacks; when to drain, and the question whether operation should be performed when the signs indicate the beginning localization of an abscess.

**Drainage.**—During the past year at a period in my operative experience which naturally should be considered better than ever before, I have lost two cases from post-operative peritonitis: one an acute, the other a chronic, in both of which the wounds were closed without drainage.

In the acute case the gangrenous appendix distended with pus was completely surrounded by omentum; the peritoneal cavity contained a little cloudy fluid, but there was absolutely no evidence of peritonitis; the caecal end of the appendix was free, so that amputation with inversion of the stump could be performed first; then the omentum was ligated in apparently uninvolved tissue. In this way the infected appendix and its surrounding omental capsule were isolated and surrounded by gauze. At the last moment as the mass was lifted out of the abdomen, just before the last omental vessel was clamped and divided, a rupture took place and purulent material leaked on the protecting gauze, but not into the peritoneal cavity. At the end of the operation there was nothing to drain; everything looked clean, and the wound was closed. The patient was critically ill before operation and had been so for forty-eight hours; the symptoms were general, that is, there was some distention, general rigidity and tenderness. This could be easily explained by the medially situated inflamed omental mass. I have frequently encountered similar pathological conditions and the same soiling; in these cases, too, the wound was closed without drainage, with no fatal result. In this patient, however, the distention after operation increased, but, strange to say, there was a falling leucocytosis. Subjected to relaparotomy forty-eight hours after operation with enterostomy and drainage the patient did not recover.

In the second case the operation was between attacks. The appendix was plastered to the caecum and there was a pathological anastomosis between the tip of the appendix and the caecum, Fig. 44a. Except for



the closure of the two openings in the cæcum the operation presented no unusual features. The necessity of drainage never occurred to me. After operation this patient developed symptoms of a diaphragmatic pleurisy and basal pneumonia, with, at first, no abdominal symptoms; then, after three days, suddenly foudroyant symptoms of peritonitis. Unfortunately, in neither of these cases, have we bacteriologic studies. I have given both the most critical study with the conclusion that if drainage was indicated and could have saved these patients, it will be necessary in the future to drain practically every case of appendicitis. These two cases represent my first experience with such a catastrophe.

I am of the opinion that in these two cases there was an unusually virulent organism, and doubt if drainage would have changed the result.

Local symptoms, especially muscle rigidity, with a rising leucocytosis, or better, with a differential count showing a distinct increase in the percentage of the polymorphous leucocytes, should be considered sufficient symptoms to justify exploration. I have gone over my own cases and those observed in Halsted's clinic on a number of occasions, and have been unable to convince myself that delay in acute appendicitis, at any stage, is justifiable. Cases which recover after delay would have recovered just as well if the operation had been performed earlier. My investigations convince me that the mortality of waiting will be greater than that of immediate interference.

INTESTINAL OBSTRUCTION.—Quite recently I reviewed my notes on cases of intestinal obstruction which I had observed, and at the same time read the more recent and comprehensive communications in the literature.—The most important conclusions I have published (Intestinal Obstruction, *Maryland Medc. Jr.*, April, 1907, Acute Dilatation of the Stomach—Gastro—Mesenteric Ileus, *Annals of Surgery*, Nov., 1907, vol. xlv, p. 737).

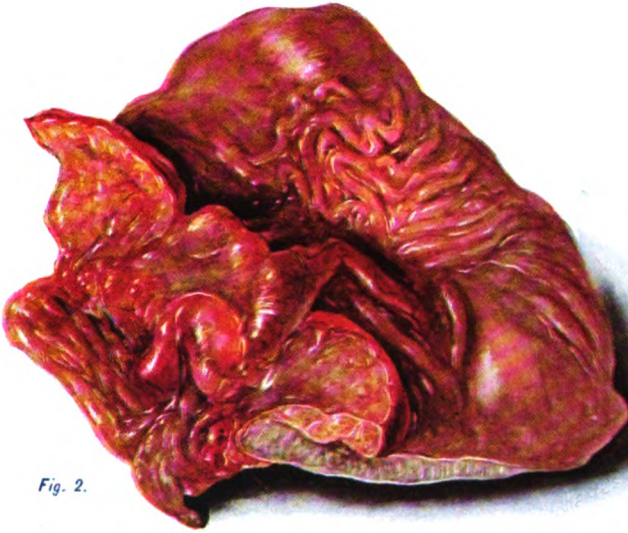
The most impressive fact is the high mortality which apparently is due to some form of toxæmia. In many cases this is unassociated with peritonitis or gangrene of the intestine. The higher the obstruction is seated the more intense are these symptoms and the quicker the fatality. All authorities look upon the toxæmia as a form of auto-intoxication due to absorption from the contents of the intestine above the obstruction. Maury (*Annals of Surgery*, October, 1907, vol. xlv, p. 556) from his experimental investigation is of the opinion that in high obstruction the toxic agent is bile, McCallum bacterial toxins. Maury's work is a very interesting and very suggestive one.

Irrespective of the exact origin of these toxins there is no longer

PLATE II



*Fig. 1.*



*Fig. 2.*



*Fig. 3.*

FIG. 1—(FIG. 44 b.) Chronic appendicitis showing perforation (there was a pathological anastomosis between this perforation and the cecum). Painting of fresh specimen after removal, by Miss Hayes.

FIG. 2—(FIG. 41.) Carcinoma of stomach, tumor at pylorus. Stomach and duodenum opened longitudinally. Painting of fresh specimen by Miss Hayes.

FIG. 3—(FIG. 5.) Fibro-myxo-chondroma arising from the periosteum of the os calcis. A benign tumor. Painting of fresh specimen by Miss Hayes.



any doubt that the chief danger in intestinal obstruction is absorption of the contents of the intestine above the obstruction. With this fact clearly in mind practitioners would be influenced in favor of earlier intervention and surgeons at the operation will know that in many cases simple relief of the obstruction is not sufficient, the bowel above must be opened, evacuated on the operating table, and in some cases temporary enterostomy performed. These two latter procedures are more important than the former (relief of obstruction), in those cases in which the surgeon must choose.

Ileus is not a frequent occurrence. The average practitioner sees but few cases. The clinical picture which is not at all difficult to recognize is not manifest until such a late stage in the disease that the per cent. of recoveries after relief is very small.

Practically every case of intestinal obstruction should recover if the abdomen is opened sufficiently quickly after the first operation. It is imperative that the symptoms and signs of this early favorable period be known.

The most important symptoms are initial pain in the abdomen and shock, usually associated with nausea and some vomiting. Early careful examination may find the distended loop through the abdominal wall or per rectum or vagina (Von Wahl's sign). Peristalsis is pathognomonic but this is not always to be elicited in acute cases. Leucocytosis is often present. Enemata and washing out of the stomach do not give relief. For further more definite signs one should not wait. For example: fecal vomiting and marked distention. The mistake made by the physician who first sees these cases is, that he does not look upon acute abdominal pain as the most important sign, but views it as a symptom to be relieved at once. Morphia and cathartics should not be given until an operable abdominal lesion is excluded. As a rule in these cases the diagnosis is not made until these symptoms increasing in number and distinctiveness force themselves upon the practitioner. There is not a single contribution from a surgical clinic which does not bear evidence that the great majority of these cases come for surgical aid very late. That an earlier diagnosis is possible is borne out by the comparison with post-operative obstruction observed in surgical clinics. Although these patients have already been subjected to one operative procedure, the mortality is less, due entirely to early intervention based upon the recognition from the minimum of symptoms. Progress in surgery at least depends upon the recognition of disease from its minimum symptoms, and avoiding delay until the maximum symptoms are evident. In intestinal obstruction diag-

nosis therefore is the first important point. To get the best results the abdomen should be opened at the latest within twenty-four hours. In my own experience the recognition of the lesion within the first twenty-four hours should not be difficult. I cannot in a short review consider the details, but I wish to emphasize to those members of the profession who have had little experience with this acute abdominal trouble, and who have not read the recent communications, the importance of critically studying all patients who seek their advice for acute abdominal pain. It may be necessary to spend an hour watching such a patient, giving them an enema, perhaps washing the stomach out. If the diagnosis cannot be made then one should return quickly for a second visit. Unfortunately the use of drugs has become such a part of the mental attitude of the physician, that when the patient cries for relief it requires great courage to refrain. It is so much easier to give a hypodermic of morphia than a rectal enema or a gastric lavage.

After the abdomen is opened the surgical problems are by no means simple: first, the best means of finding quickly the obstruction; second, the decision whether the distended loop shall be immediately evacuated; the question between simple enterostomy or the permanent relief of the obstruction with or without enterostomy; third, the study of the circulation of the obstructed loop; when resection is indicated, the method of procedure.

Of all these problems the most important is the selection of the cases for immediate evacuation of the contents of the intestine and the decision as to enterostomy. Except in very early cases, perhaps less than twenty hours, this should not be neglected. I am convinced that surgeons have been neglectful in this point of the technique.

Fig. 45 is a photograph of the small intestine resected on account of gangrene due to mesenteric thrombosis. I saw this patient at the end of the third day of his illness. The pain that this patient suffered during the first twelve hours of the attack should of itself have been sufficient indication for operation. When the abdomen was opened it contained blood-stained serum, a positive sign of obstruction or pancreatitis in acute lesions. Then the gangrenous loop was found. I felt that it was imperative to evacuate the distended upper intestine first. This was done quickly. Through this incision the upper loop was anastomosed with a loop below the area of gangrene. This lateral anastomosis was demanded on account of the shortness of the upper loop. Enterostomy in such cases is quickly associated with starvation and extensive dermatitis. The patient's condition was so greatly

**FIG. 45.**



**Photograph of intestines removed on account of gangrene due to mesenteric thrombosis.**



improved that I felt justified in doing an immediate resection of the gangrenous gut. The two ends were left out of the abdominal wound. The patient exhibited symptoms of complete relief. There was no vomiting, the bowels moved, at first the faecal matter was hæmorrhagic, then normal. The anastomosis worked immediately and perfectly. There was no discharge from the open ends of the intestines in the wounds. On the fifth day the patient had acute abdominal pain, profuse hæmorrhage from the lower loop, and died in six hours. An autopsy was not allowed, but I felt confident that there was secondary and further thrombosis with gangrene.

In this case I removed at least twelve inches of healthy gut beyond the line of gangrene. In the post-operative mortality of mesenteric thrombosis further extension of the process after resection has quite frequently been the cause of death, and the question naturally arises should one resect much more healthy gut.

**EXTENSIVE RESECTION OF SMALL GUT.**—The investigation of Storp teaches us that for all practical purposes a surgeon need not hesitate to resect as much of the small intestine as is indicated. In gangrene due to mesenteric thrombosis it is better to err on the side of resecting too much than too little.

Storp's (*Deutsche Zeitschr. f. Chir.*, 1907, vol lxxxvii, p. 313) communication is of value, because it records 22 cases of successful resection of 200 or more cm. of small intestine. In Storp's case 510 cm. were resected. This case is second only to that of Nigrisoli—520 cm.

Storp's case was a male aged 21, with a sarcoma of the ileum; the resected 510 cm. included the ileum and part of the jejunum. The patient gained in weight and was well for five months, then there was evidence of the sarcoma. Nigrisoli's patient was a male aged 22; the resection was done because of an ileus with adhesions. First there was a lateral anastomosis between jejunum and colon and later resection of 520 cm. of the excluded intestine. Examinations of the metabolism demonstrated a return to the normal after the 22nd day. This case remained perfectly well. According to various authorities—Henle, Holstein, Dreike, Trzebicky—the length of the small intestine not including the duodenum varies from 416 to 870 cm. with an average of about 632 cm. Beneke states that to every 100 cm. of length of body there is 387.5 cm. of small intestine. If this is true in Storp's and Nigrisoli's patients at least three-fourths of the small intestine were removed without apparent injury to the patient.

Senn in 1892 was the first to report on animal experiments; he concluded that it was dangerous to resect more than one-third. Trzebicky



increased this to one-half, while Monari in three out of five dogs successfully resected seven-eighths of the small intestine, but when he removed eight-ninths all of the animals died. Diliberti-Herbin after removing half of the intestine killed the apparently well dogs 93 days later.

At first there had been some change in the metabolism, but later this had become normal. Examination of the intestine at autopsy demonstrated compensatory hypertrophy not only of the coats, but also of the glands. Apparently longer portions of the intestine can be removed if the resection is confined chiefly to the lower, leaving more jejunum. In the literature Dreesman in 1899, Kukula in 1900, Payr in 1902, and later Schlatter, have collected successful cases. Storp retabulates and finds 22, including his own case, in which 200 cm. or more of the intestine has been removed. That is, at least one-third of the small intestine was removed in these cases. Storp prefers the end-to-end anastomosis after resection.

### Hernia

**INGUINAL HERNIA.**—This subject still presents two problems: the selection of the more difficult cases for which the ordinary simple operation does not give the best assurance of a permanent cure, and the treatment of strangulated hernia with gangrene of the intestine.

For the ordinary inguinal hernia the operation performed to-day by most surgeons is a simple one and consists of different steps, taken from different methods, which have in the past added to the evolution of this operation. I have always been impressed, in studying the different methods that have been devised from time to time that there was a common factor in all of them. This consisted in the suture of the internal oblique muscle and the conjoined tendon to Poupart's ligament. MacEwen, one of the first surgeons to accomplish the greatest number of permanent cures, emphasizes the suture of the lower portion of the internal oblique and the conjoined tendon to Poupart's ligament. In spite of this he attributed the success of his operation to the special treatment of the sac. The sac was isolated, crumpled with a purse-string suture into a mass and fixed by suture well up under the internal oblique muscle. To do this, it seems to me, one would have to dissect pretty freely the internal oblique muscle, so that after the sac was fixed this muscle was properly prepared for a dislocation downwards and fixation with the conjoined tendon to Poupart's ligament. MacEwen had to confess that in many cases the sac was so small that it practically amounted to nothing; yet, the

results were equally as good. Observation has demonstrated that the size of the sac outside the external ring has no comparative relation to the defect in the abdominal wall where the neck of the sac is situated. I have always been of the opinion that the elements of success in MacEwen's operation were due to the suture and that his treatment of the sac was unessential. Previous to this the methods of Czerny, Banks and others were based upon the supposition that excision of the sac and closure of the external ring were sufficient. It is not improbable that very frequently in closing the external ring the operator included with the aponeurosis of the external oblique the conjoined tendon and internal oblique muscle, and so made the proper approximation to Poupart's ligament. It is in these cases that cures were accomplished because there is no doubt that when the wound healed a certain number of permanent results were obtained. Halsted and Bassini were impressed that the cause of recurrence was the inability to make a proper approximation of tissue about the cord in the lower angle of the wound; so they transplanted the cord. But Halsted distinctly writes in his first communication that he was of the opinion that the wound in inguinal herniæ should be made and closed on the same principle as employed in any other laparotomy wound. That is, both muscle and aponeurosis must be approximated. Halsted, in order to transplant the cord higher divided the internal oblique muscle transversely across its fibres, placed the cord in the upper and outer angle of the triangular defect, and then sutured all the divided tissue below. The conjoined tendon was always included in the lower one or two sutures. When I studied the ultimate results of the cases operated on in Halsted's clinic (*Johns Hopkins Hosp. Reports*, vol. vii, 1889, p. 293) I found that in the larger group of simple hernia in which the wound healed per primam there was not a single recurrence in the lower angle of the wound. In the upper angle of the wound where the transplanted cord perforated the abdominal wall to the subcutaneous fat there were three per cent. of recurrences. These recurrences were only observed when the entire cord with a large bundle of veins was transplanted. In those cases in which the veins had been excised and only the vas deferens and a few remaining vessels transplanted the results were absolutely perfect. This evidence demonstrates that in Halsted's original operation the internal oblique was properly sutured.

The objection to transplanting the cord with the veins was therefore that it created a point of weakness in the upper angle of the wound. To transplant the cord after the excision of the veins was associated

with the danger of epididymitis and atrophy of the testicle. The point that I wish to emphasize, however, is that Halsted, like MacEwen, succeeded in making a proper approximation of the internal oblique and conjoined tendon to Poupart's ligament. Bassini transplanted the cord differently. His idea was to restore the obliquity of the inguinal canal. In Bassini's operation the cord is lifted up, the internal oblique sutured beneath it to Poupart's ligament well below the edge; the cord dropped on the internal oblique. Now the aponeurosis of the external oblique is sutured to the edge of Poupart's ligament. Bassini, therefore, apparently without being aware of it, was the first to make a distinctly imbricated suture. Although I have never done a Bassini operation, I have operated five times for recurrences in which the first operator had performed a Bassini. The recurrence, similar to that after the Halsted method, was at the position of the transplanted cord, and in every case the veins were sufficiently large to speak of the condition as a varicocele.

Andrews of Chicago was one of the first, if not the first, to elaborate the imbricated approximation of all the separated tissue. Ferguson, whose book on hernia has recently been published, places the greatest emphasis on the high position of the internal oblique muscle in inguinal hernia and mentions the necessity of freely separating it, dislocating it down and properly suturing it with the conjoined tendon to Poupart's ligament.

I have just read Dr. Edward Martin's chapter on the operative treatment of hernia in galley-proof. It is to appear in the second volume of Kelly and Noble's *Operative Gynecology*. Asked by Dr. Martin to express my personal opinion as to the method in simple hernia I answered as follows: After dividing the aponeurosis of the external oblique, Poupart's ligament should be well exposed; then the aponeurosis of the external oblique should be separated with the gloved hand until one gets a good view, and a broad one, of the sheath of the rectus, the linea semilunaris and the internal oblique muscle. Now the coverings of the sac are divided in the direction of the inguinal canal preserving their posterior attachments. The sac is isolated and separated from the cord without disturbing the latter. The opening into the peritoneal cavity is closed, the excess of the sac excised. Now the stump of the sac is sutured beneath the internal oblique muscle. This was first advocated by MacEwen who preserved the sac and later by Kocher who excised the sac. It is my opinion that it is unnecessary. It seems to me it is performed as a compliment to these two surgeons, who in their work contributed to the development of the operation. It

certainly can do no harm. It does do some good, for to accomplish it properly one must separate the internal oblique muscle.

After this treatment of the sac the edge of the internal oblique muscle should be isolated down to the conjoined tendon, the width and strength of the conjoined tendon estimated. My own experience teaches me that the condition of the conjoined tendon which when normal protects the lower third of Hesselbach's triangle, is the key to the correct separation of inguinal herniæ into two groups. When the conjoined tendon is wide and strong the hernia belongs to the simpler group; when it is narrow, relaxed or absent the hernia must be considered of the more difficult variety and a modification of the operation instituted. Having demonstrated the strength and width of the conjoined tendon the wound is now prepared for the method of closure sufficient to insure a permanent cure in the simpler cases. But before this, I agree with Halsted, that the veins if large should be excised. It has been demonstrated without doubt that both in the Bassini and in the Halsted method of transplantation of the entire cord a weak spot is made in the upper angle and a certain small per cent. of recurrences have been observed. It is quite possible that the larger cord in the lower angle of the wound would act in the same way. The largest portion of the cord is the veins. If the vas deferens and its immediate vessels are not disturbed there is absolutely no danger of atrophy of the testicle from excision of the vein. In making the simple suture one can first cover the cord with its original coverings which, I mentioned in the beginning, should be preserved. In some cases the infundibuliform fascia and cremaster muscle are of considerable thickness and there is surely no objection to utilizing them. However, I am skeptical as to their actual value. In so many cases these tissues are so attenuated that they amount to actually nothing. Yet, the ultimate results are just as good. When these coverings of the cord can be utilized for suture it has the advantage of fixing the cord and holding it out of the way during the suture. In the simpler suture the conjoined tendon and the internal oblique muscle are first approximated to Poupart's ligament at some distance from the edge. Then the edge of Poupart's is sutured to the sheath of the rectus, the linea semilunaris and the internal oblique muscle. It appears to me that this is the most essential part of the operation. The lowest suture should approximate the conjoined tendon to Poupart's just above the pubes, making a snug closure about the cord. In carrying the suture higher get as far away from the edge of Poupart's ligament in the first imbrication, carry it as high as possible. Now the aponeurosis of

the external oblique is sutured to Poupart's overlapping its edge. When I first employed this method I used interrupted silk, but now I find that continuous catgut is quicker, it seems to make a more perfect approximation, and the immediate and late results have been just as good.

This method of operation in the simpler hernia should be credited to no one surgeon. It is a composite one, the result of development, and seems to embrace the essential features of many.

For the inguinal herniæ more difficult to cure a modification of the preceding method will, I am sure, give better results. In the publication first referred to I found after careful investigation that in about five per cent. of all inguinal herniæ the conjoined tendon was obliterated and that in these cases Halsted's operation which had accomplished uniformly perfect results, as far as any weakness of the lower angle of the wound, was followed in at least fifty per cent. of the cases by recurrences (*Johns Hopkins Hospital Bull.*, vol ix, 1898, p. 96). For this smaller group more difficult to cure I devised and practised the exposure of the rectus muscle through a division of its anterior sheath and its transplantation and suture to Poupart's ligament in the lower angle of the wound; this strengthens that portion of Hesselbach's triangle which in ordinary cases is sufficiently protected by the conjoined tendon. At about the same time Wölfler introduced the same procedure for all inguinal herniæ. As far as I have been able to ascertain the results in my cases of rectus transplantation have been perfect. At the present time I prefer to employ Halsted's modification which he describes in his paper on the operative treatment of the more difficult case of inguinal hernia (*Johns Hopkins Hospital Bull.*, August, 1903, vol. xiv, p. 203). Instead of dividing the sheath of the rectus Halsted makes a triangular flap of the anterior sheath; the undivided base of this flap is along the outer border of the muscle down to the pubes. When this flap is separated and turned over and sutured to Poupart's it is practically a conjoined tendon. After this is done the rectus is also sutured to the ligament. Halsted's method is simpler and theoretically better, because both thick aponeurosis and muscle are sutured to Poupart's ligament. In other details the operation is the same as just described for simple hernia. During the past two years I have had a greater number of operations for recurrent hernia than before. In all of these the first operator had performed an operation sufficient for the simpler hernia, but I am quite convinced, from my findings, that the ruptures belonged to the more difficult group. At the second operation the sheath and the rectus muscle were employed

to strengthen the defect in the lower angle of the wound above the pubic bone—the position of the recurrent hernia. So far the results in these cases have been satisfactory.

*The Removal of the Appendix as a Routine Procedure in the Operation for Right Inguinal Hernia.*—During the last year it occurred to me that it would be perfectly justifiable to remove the appendix at the operation for hernia on the right side. The operation for hernia has become so simple, and when one uses continuous catgut it can be accomplished so quickly that it seemed to me that something more should be done for the patient, if possible. There is no doubt that whenever the abdomen is opened the appendix should be removed if this can be accomplished without adding any risk to the necessary operation. I have found no difficulty in getting the appendix through the hernial opening. Usually it is hooked with the index finger or fished for with a clamp. The most important point is to use no traction on the appendix, because in some individuals with much fat in the mesentery of the appendix the mesentery is easily torn. Having found the appendix the cæcum can be brought out of the wound by gentle traction. If this could not be accomplished I would not attempt the appendectomy, except through a second incision. The study of these appendices has been of great interest. In at least about half of the cases I found gross and microscopic changes which we find in patients operated on between attacks. Yet, so far, none of the patients with hernia have given a history suggesting appendicitis. This finding is by no means new.

**BILATERAL OPERATION FOR INGUINAL HERNIA.**—German surgeons advocate operation on both sides in all cases if there be no contraindication. This is based upon the fact that a certain per cent. of patients, in those clinics in which the ultimate results are carefully followed, return with hernia on the other side. The exact per cent. has not been worked out.

In my own experience it has been sufficient to justify the bilateral operation in children and young individuals, providing the operation on one side presents no especial difficulty, the patient takes the anæsthetic well and there is no contraindication for a little longer ether. It is my practice now to do the bilateral operation, removing the appendix in addition.

**STRANGULATED, GANGRENOUS HERNIA.**—In December, 1906, in answer to a letter from Dr. Baber I looked up the results of strangulated hernia in Halsted's clinic, and was struck by the high mortality. Among 98 cases in which the circulation of the intestine was so good

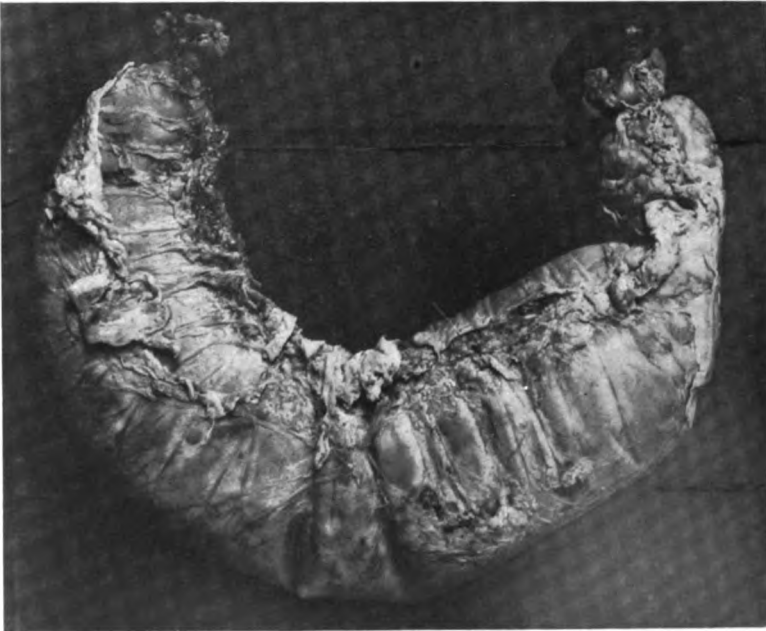
that the gut was returned there was a mortality of ten per cent. In some of these there were other factors besides autointoxication. This bears out the statement made under intestinal obstruction. In four cases there was gross and bacteriologic evidence of peritonitis without gangrene. All of these patients succumbed.

In 21 cases in which the intestine was gangrenous there were but five recoveries; in three of these the operation was performed within a few hours after the first symptom with immediate resection and suture; in the other two enterostomy was performed. Without going into details, I am impressed, from the facts studied in these cases, that the most important factor to be considered is the immediate relief of the distended upper loop. For patients who are seen within six hours after the first symptom and in which there is very little distention of the upper bowel and no faecal vomiting, immediate resection and suture may be done, but in all other cases evacuation of the accumulated contents above the obstruction should be done, followed by enterostomy in critically ill patients. The resection and suture of the gangrenous portion, as an immediate or secondary procedure, should be governed by the condition of the patient. In femoral herniæ always, and in the majority of cases of inguinal herniæ, after the relief of the obstruction a second incision should be made in the abdominal wall above, the gangrenous gut pulled out here, and all further operative procedures on the intestines performed through this new laparotomy wound. In the past, it seems to me, good results can be attributed rather to good luck than good judgment. In the future, due to the saving of time by the second incision, our better methods of emptying the bowel and intestinal suture, we will be able to get far better results with apparently more radical procedures. In my last case of strangulated femoral hernia with gangrene the moment the sac was opened and the condition revealed, I sponged out the blood-stained fluid, divided the constriction, covered the gut with moist gauze, made a McBurney incision above, pulled the loop out here, evacuated the upper loop, did a lateral anastomosis with clamps eight inches from the line of gangrene, and as the patient's condition was good, resected and left the upper end of the gut in the wound to act as a safety valve. The patient recovered, although the symptoms had been present fourteen hours. It represents the only case of recovery, in my series, so long after the onset.

#### Surgery of the Colon

GIANT COLON, HIRSCHSPRUNG'S DISEASE.—Fig. 46 is a photograph of a giant colon excised by Finney at the Union Protestant Hospital.

FIG. 46.



Photograph of giant colon. Hirschsprung's disease. (Finney's case).





Neugebauer (Archiv. f. klin. Chir., 1907, vol. lxxxii, p. 503) in re-reporting two cases in children aged nine and eleven years respectively, was able to confirm the diagnosis by introducing Kuhn's metallic spiral sound through the rectum into the colon and taking an X-ray. In one of his cases he got a splendid result by anastomosing the non-dilated hepatic portion of the transverse colon to the dilated rectum. The etiological factors in this rare and apparently congenital disease are not yet established [Zezas (Zentralbl. f. Chir., 1907, vol. xxxiv, p. 49).]

**VOLVULUS OF SIGMOID (GIANT) COLON.**—In August, 1906, I had the opportunity to resect a giant sigmoid colon. This case was reported briefly before the Southern Surgical and Gynæcological Association and appeared in its *Transactions* for 1906. The observation is of great interest clinically because the patient during sixteen years had been admitted to the Johns Hopkins Hospital thirty-two times with acute attacks of obstruction. On the first two occasions the abdomen was opened and the torsion relieved. At the other attacks relief was accomplished by high rectal enemata. The patient, however, desired permanent relief as the attacks were increasing in frequency. Since the operation eighteen months ago the patient has not only been free from attacks, but he has observed a great improvement in his health; he has gained in weight, he is no longer nervous and is now able to eat everything. This change suggests that he was suffering from a chronic autointoxication.

In January, 1907, I observed for the first time an acute attack of volvulus and was able to get a picture of its pathology at the laparotomy. These cases are about to be published with a discussion of the literature.

With our improved technique of intestinal anastomosis it is the general opinion that resection should be performed for volvulus of the sigmoid. If the acute case is not observed early and the general condition of the patient is not good one should be content with simple reduction of the torsion if rectal enemata fail, but if seen early, especially in recurrent cases, resection is indicated. Since 1902 I have been unable to find in the literature any collective review as comprehensive as Kuhn's (Beiträge z. klin. Chir., 1902, vol. xxxvi, p. 411). At that time the mortality in twenty cases of resection was about fifty per cent., but in most of these cases the operation was performed in the acute stage and in a number the bowel was gangrenous. Garré is the only surgeon who has reported a successful resection when the intestine was gangrenous.

**CHRONIC COLITIS.**—The symptomatology of this lesion is not difficult to interpret, but the etiological factors are numerous. It is of extreme importance to differentiate these cases into the neurotic, the simple inflammatory, the grave inflammatory, those due to carcinoma and those due to chronic appendicitis, or some pelvic inflammatory lesion. For the neurotic operation is contraindicated; in the simple inflammatory colitis medical treatment usually accomplishes a cure; in the more grave inflammatory lesions surgical intervention may be necessary; in regard to the other forms there is no question as to operation. In the first instance the possibility of a carcinoma in some part of the large intestine as the etiological factor of the chronic colitis must be excluded; if there be any doubt exploration is justifiable. As methods of diagnosis, when there is no palpable abdominal mass, or signs of chronic partial obstruction, we have the sigmoidoscope which will allow a view of the rectum and sigmoid colon, and exploratory laparotomy should be given serious consideration. It is simple and keeps the patient abed but for a few days. It allows the physician at once to exclude the simpler and more grave lesions, the cause of the symptoms, and when the abdominal findings are negative, to carry on with greater assurance the simple local treatment or the suggestive treatment, if there be a neurosis.

The medical aspect of membranous colitis was presented in a very thorough paper by White (*Lancet*, October 28, 1905) in which he reports sixty cases of his own observation and advises operation only in extreme cases and as a last resort. Gill (*Zentralbl. f. Chir.*, 1906, vol. xxxii, p. 1356), a Spanish surgeon, in discussing the surgical treatment recommends Weir's appendicostomy, and Mummery (*Lancet*, June 15, 1907) contributes quite an extensive article with special reference to the surgical treatment.

In view of the more serious etiological factors which may not present themselves to our present methods of examination, the first, most important step is to examine the entire transverse colon and the peritoneal cavity about it. To perform appendicostomy without exploring the abdomen, it seems to me, would be throwing away the opportunity for a correct diagnosis. The drainage afforded by an appendicostomy will be unnecessary in the simple cases and of very much less value than total exclusion of the colon in severe cases. At the exploratory laparotomy one, then, will be able to determine the cause and act accordingly.

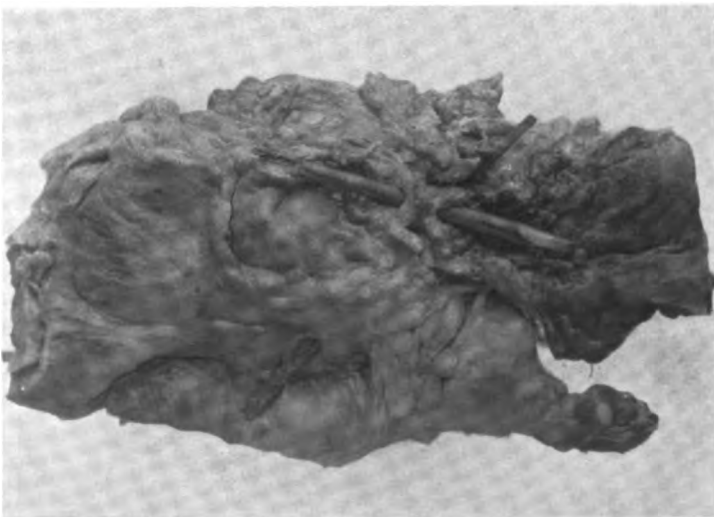
Fig. 47 represents how I employ the appendix preliminary to making a large opening in the cæcum for the total exclusion of the colon

FIG. 47.



Photograph of operation (Schapiro) to illustrate the method of appendicostomy which is not advised for chronic colitis.

FIG. 48.



Tubercular adenitis, glands of mesentery, with secondary involvement of wall of intestine at ileo-cecal junction producing a stricture. (Probe in constricted ileo-cecal orifice). There was also a pathological anastomosis between the tip of the appendix and the ileum, making two openings between ileum and cecum. (Photograph of alcohol specimen.) Operation by Finney.



as recommended by Moszkowitz (Mittheilungen a. d. Grenzgeb. d. Med. u. Chir., 1904, vol. xiii, p. 659). In this case there was no question as to operation. The hæmorrhagic mucus diarrhœa had been present four years; the extensive ulceration could be seen and felt per rectum; it appeared to me too extensive for carcinoma, and even if it were malignant it would have been inoperable. I explored the abdomen in the middle line. The upper portion of the rectum and the lower portion of the sigmoid were thickened and adherent to the surrounding parietal peritoneum. The entire picture, however, was one of inflammation and not of new growth. I decided to arrange for continuous irrigation of the sigmoid and rectum, and temporarily to exclude the entire colon. An enterostomy was performed in the middle line with the sigmoid, and through a McBurney incision in the right iliac fossa a similar operation on the cæcum. As I decided not to open either bowel for some days I used the appendix as a temporary safety valve for gas and irrigation. When the cæcum was opened on the fourth day all the fecal matter passed this way putting the remainder of the colon at rest. Through this opening in the cæcum, the one in the sigmoid and per anum the entire colon was irrigated twice a day. The ulceration rapidly healed, and most of the inflammatory thickening disappeared. After two months both enterostomies were allowed to close, and the patient left the hospital apparently well.

In some cases, on opening the abdomen a tubercular colitis will be exposed (Fig. 48). Resection is usually indicated. These cases of chronic hyperplastic tuberculosis have been carefully studied by Lartigau (*Jour. of Experim. Med.*, Nov. 29, 1901, vol. iv, No. 1).

### Surgery of the Intestines

**CARCINOMA OF THE LARGE INTESTINE AND RECTUM.**—The anatomical and clinical research of Petersen and Colmers (Beiträ z. klin. Chir., 1904, vol. xliii, p. 1) on carcinoma of the stomach and intestines gives the best description of the modes of local growth and explains the clinical differences and the variable curability. The greatest numbers of permanent cures have followed resection of the colon in tumors situated at or between the ileo-cæcal valve and rectum. The prognosis for carcinoma of the rectum situated below the promontory of the sacrum is not as favorable as the former group, and in carcinoma of the stomach the results are distinctly worse. Experience in malignant tumors of the small intestine is yet too scanty to form any estimate.

The stomach has two mesenteries with the double opportunity,

therefore, for infiltration beyond the peritoneal coat and lymphatic involvement. The lymphatic supply of the stomach is greater than that of the large intestine. The rectum below the sigmoid has no peritoneal coat and pathological examinations demonstrate early involvement in this region of this unprotected portion and the evident infiltration of the fatty connective tissue between the rectum and sacrum.

In all carcinomas of the intestine the tendency of the tumor is to infiltrate along the wall between the mucous membrane and submucosa. Frequently large flat ulcers or fungous growth take place with a base of almost normal peritoneum and muscularis. This picture is most evident in carcinoma of the colon. Fig. 49 and Fig. 50 are photographs of the alcohol specimen in carcinoma of the rectum, and demonstrate the wide extent of the superficial ulcer.

Some of the points in the operative treatment I have discussed (*Surgery, Gynecology and Obstetrics*, vol. iii, p. 284). The operative treatment with the best methods of anastomosis has recently been discussed by Wm. J. Mayo.

#### Surgery of the Brain

In the third volume of Keen's Surgery (published by W. B. Saunders Company, 1908) the first chapter devoted to the surgery of the head has been prepared by Cushing. In these 276 pages anyone interested in this subject will find that it will not be necessary for him to look further. The illustrations are unusually satisfactory and the bibliography a welcome addition. Due to the original work of Cushing, Frazier and others in this country, America's contribution to improved technique ranks with the best.

At the present time perhaps the greatest interest centres in what can be accomplished in the various forms of epilepsy by operative treatment. In those cases associated with no gross anatomical defects there are two methods of procedure: that recommended by Horsley in which a section of the precentral gyrus is extirpated; the area selected corresponds to that controlling the muscular contractions which appear first in the convulsions. Cushing states: It has not, however, in its results proven a method of exceptional value, and the cases suitable for its employment are few. The one advocated and employed by Kocher is based upon the theory of relief of cerebral tension, and a piece of dura is excised.

Cushing's summary of his personal results, it appears to me, is very suggestive. Among 128 cases he selected only 59 for operation.

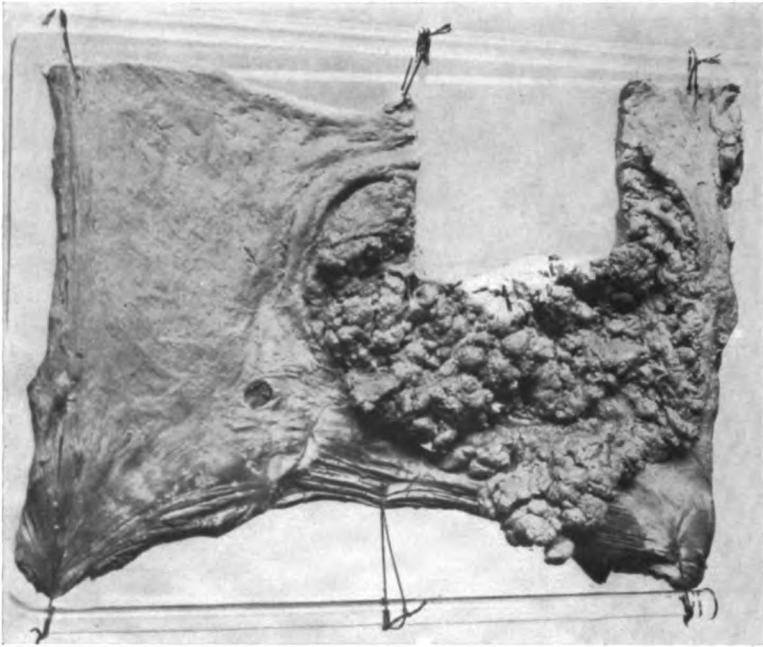
**FIG. 49.**



Carcinomatous tumor, upper third of rectum. Removed by combined abdominal and sacral routes; photograph of alcohol specimen. Bowel opened longitudinally; tumor partially cut through. [This patient is well 7 months since operation. (See *Surg. Gyn. and Obs.*, Aug. 1906.)]



FIG. 50.



Carcinomatous ulcer, lower third of rectum. Removed by sacral route; photograph of alcohol specimen, showing ulcer and mucous membrane surface of rectum opened longitudinally. This patient has remained well  $7\frac{1}{2}$  years since operation.

**FIG. 51.**



**Photograph of patient showing defect after exploratory craniectomy  
for traumatic epilepsy.**

**FIG. 52.**



**Sarcoma of testicle; fibromyxosarcoma. Photograph of fresh specimen.**

In some of these, he writes, that against his better judgment he was induced to operate, and here, in a few cases, unexpectedly found, and was able to correct, conditions which have apparently resulted in cures. While, on the other hand, when from the history and clinical picture, operation was distinctly indicated with an apparently favorable prognosis, both from the findings before and at the operation, there have been a number of dismal failures. Apparently, therefore, at the present time there is no positive method in the selection of cases. Some recent authorities are of the opinion that every case of epilepsy should be given the benefit of at least an exploratory operation. Cushing does not commit himself to this, but it seems to me no other conclusion can be reached after reading what he says.

Fig. 51 illustrates the defect after an exploratory craniotomy and the removal of an area of bone in a case of traumatic epilepsy. I could not ascertain from the patient whether the bone was depressed, nor could I get any information from the surgeon who operated. The attacks had been present some four years beginning a few months after a severe injury of the head in this region. There had never been a distinct aura, and the convulsions were always general. Two years after the injury this piece of bone was removed. He was relieved for a few months and since then the convulsions have been less frequent—about once a month. At my operation I dissected the scalp from the dura and excised a small zone (5 mm.) of the dura along the periphery of the bone defect. Since the operation the patient has had no attacks—a period of now nine months.

Kotzenberg (*Beiträge z. klin. Chir.*, 1907, vol. lv, p. 326) in his contribution to the question of idiopathic epilepsy gives a very interesting historical review of the literature, summarizes the cases operated on in Kümmel's clinic in Hamburg and concludes that with few exceptions all cases should be given the benefit of operation; he prefers Kocher's method to any other.

#### Surgery of Spine and Peripheral Nerves

Space forbids a resumé of the splendid monograph on neurological surgery contributed by Murphy of Chicago (*Surgery, Gynec. and Obst.*, vol. iv, April, 1907, p. 385). It consists of 116 pages and is well illustrated. Surgeons will find it a very convenient reference.

Loeb (*Mittheilungen a. d. Grenzgeb. d. Med. u. Chir.*, 1906, vol. xv, p. 513) reports on the very rare injury of the terminal cone of the spinal cord giving his four cases and the literature.

### Surgery of the Testicle

Enlargements of the scrotum rest upon more than one factor. The swelling may be due to fluid in the tunica vaginalis, [hydroceles,] or to fluid distending some of the embryonic residues, for example, the cyst of the organ of Giraldu, enlargement of the testicle or changes in the epididymis. A hydrocele, usually a simple affair, very often is but a symptom of a disease of the testicle. In both gumma and sarcoma which originate in the body of the testicle hydrocele is the sign of onset. This collection of fluid masks the real nature of the lesion behind it. It is my opinion that we should look upon a hydrocele more critically, and in case of doubt explore. The appearance of the covering of the testicle and the palpation of the testicle through a small incision will at once demonstrate the presence or absence of sarcoma or syphilis. In *INTERNATIONAL CLINICS* (vol. i, Seventeenth Series, p. 272, Fig. 17) I have illustrated a gumma of the testicle which could not be differentiated from sarcoma or a simple hydrocele until explored. Fig. 52 is a photograph of a fresh section of a fibro-myxo-sarcoma of the testicle. The patient was a male æt. 47 and the first swelling noticed 18 months ago was considered a hydrocele, but now some of the fluid has been absorbed and one could palpate the hard lobular tumor.

This form of sarcoma is not infrequent in the testicle, and the prognosis for a permanent cure is good. It is to be remembered that after excision of the veins for varicocele, whether this is done as part of an operation for hernia or not, in a certain number of cases a hydrocele follows.

### Surgery of the Kidney

In the *INTERNATIONAL CLINICS* for 1906 (vol. i, Sixteenth Series, p. 297) the most interesting neoplasm of the kidney was discussed. Fig. 53 (Fig. 3, Plate I) illustrates the characteristics of such a tumor in the early stage of its malignancy. The fibrous-tissue capsule is well marked, the definite gross lobulation and finer alveolar structure shown. Yet, notwithstanding this apparent encapsulation the tumor at one point has infiltrated into the pelvis and produced a small pedunculated fungus and in the hilus of the kidney between the ureter and the renal vein there is a discrete small nodule.

In this patient, a male aged 62, the most characteristic clinical symptom was present—intermittent hæmaturia of four months' duration. The cystoscope demonstrated blood from the right ureter only. The patient had not noticed the palpable tumor in the right flank. This tumor occupied the position of the kidney and moved with respiration. Nephrectomy was not difficult.

# INDEX TO VOLUME I

## (EIGHTEENTH SERIES)

### A

Abdomen, import of digestive disturbances in the diagnosis of surgical lesions of the, 123  
surgery of, 278  
Abdominal, belt in whooping-cough, 198  
operations, drainage in, 279  
incisions in, 278  
Abscesses, fixation, 128  
Acidity and alkalinity of urine, 66  
Acromegaly, 249  
Adams-Stokes disease, 239  
Addison's disease, 249, 252  
Air treatment in pneumonia, fresh, 193  
Adrenalin and arterial disease, 241  
Alkalies in diabetes, 207  
Alkalinity and acidity of urine, 66  
Amyl nitrite in hæmoptysis, 218  
Amoebic dysentery, 219  
Anæmia, 209  
and intestinal disturbances, 230  
experimental, 251  
pernicious, 249, 252  
Aneurism, and syphilis, 215  
of aorta, 215, 241  
and vena cava, varicose, 241  
of hepatic artery, 240  
of left ventricle, 236  
Antidysenteric serum, 219  
Antimeningococcic serum, 199  
Antisyphilitic serum, 207  
Antitoxin, diphtheria, 196  
tetanus, 201  
Antityphoid serum, 190  
vaccination, 191  
Aorta and vena cava, varicose aneurism of, 241  
aneurism of, 215, 241  
treatment of disease of, 214  
Appendicitis, drainage in, 287  
Appendix, inflammation of, 287  
routine removal of, 297  
Arteries, diseases of, 240  
Arterio-sclerosis, 214, 242  
Arthritis, 278  
rheumatoid, 209  
Arrhythmia of heart, paroxysmal, 238  
Atoxyl, in malaria, 199  
in sleeping sickness, 228  
in syphilis, 206  
Atropin sulphate in coryza, 217

### B

Babinski reflex, 166  
Bath treatment in typhoid fever, 191  
Benedict, A. L., Urinary acidity with special reference to gastric acidity.  
—Acid and alkaline tides in urine denied, 59  
Benzoate of mercury in syphilis, 28  
Benzosalin in rheumatism, 200  
Bile in mucous colitis, 80  
Bismuth of mercury in syphilis, 28  
Blisters in rheumatoid arthritis, 209  
Blood coagulation, clinical aspects of, 31  
defibrinated in anæmias, 210  
diseases of, 249  
Blood, transfusion of, 245  
in anæmias, 209  
typhoid bacilli in, 223  
Bloodgood, Jos. C., Surgery, 256  
Bloodpressure, and renal disease, 242  
in fevers, 243  
Bloodserum, 244  
Bloodtest, occult, 233  
Boggs, Thomas R., Some clinical aspects of blood coagulation, 31  
Bone, cysts of, 264  
resection for suppurative diseases of, 113  
tumors of, 263  
Bradycardia, 238  
Brain, surgery of, 302  
Brand treatment in typhoid fever, 191  
Breast, cysts of, 275  
early diagnosis of cancer of, 274  
sarcoma of, 276  
surgery of, 272  
Brown, Lawrason, The Sanatorium, 1  
Bubonic plague, 226  
transmission of, 227  
vaccination against, 227  
Bursitis, 276

### C

Calcium, in chronic heart disease, 213  
salts in feces, 233  
to increase coagulation of blood, 39

Carcinoma, of bone, 265, 269  
 of breast, 272  
 of intestine and rectum, 301  
 of stomach, 285  
     early diagnosis of, 283  
 Cerebrospinal meningitis, 199  
 Children, pneumonia in, 193  
     vaccination in infectious diseases of, 40  
 Chloride-free diet in scarlet fever, 195  
 Cholecystitis, 90, 92  
     symptoms of, 96  
     treatment of, 97  
 Cholelithiasis, 94  
     blood coagulation in, 33  
 Chorea, vaccination in, 52  
 Circumcision of the newborn, 155  
 Claudication, intermittent, 239  
 Coagulation of blood, 31  
 Colchicum in gout, 209  
 Colitis, membranous, 300  
     mucous, 77  
     tuberculous, 301  
 Colon, chronic inflammation of, 300  
     surgery of, 298  
 Copper sulphate in amoebic dysentery, 219  
 Coryza, 217  
 Cremation in tuberculosis, 220  
 Cyst, of bone, 265  
     of breast, 275

**D**

Dardel, Jean, Notes on the treatment of syphilis by the injection of soluble salts of mercury, 22  
 Deaderick, William H., The etiology of hæmoglobinuric fever, 174  
 Deaver, John B., Diseases of the gall bladder, 89  
 Dechloridization in nephritis, 216  
 Dengue fever, 227  
     etiology of, 227  
 Diabetes, mellitus, 207, 233  
     insipidus, 235  
 Diagnosis of surgical disorders, importance of early, 258  
 Diet, in aneurism, 215  
     in arterio-sclerosis, 215  
     in diabetes, 207  
     in scarlet fever, 195  
     in typhoid fever, 192  
 Digestion, importance of disturbance of, in the diagnosis of surgical lesions of the abdomen, 123  
 Digitalis, active principles of, 213  
 Diphtheria, 196  
 Disinfection of tuberculosis, 12  
 Drainage, 261

Duckworth, Sir Dyce, Textural proclivities and immunity: the personal factor in medicine, 73  
 Duodenum, operation for perforated ulcer of, 105  
     operations on, 232  
 Dysentery, 219, 228  
     toxæmia in, 228

**E**

Eczema in the newborn, 151  
 Edsall, David L. and Nisbet, Verner, Mericine, 220  
 Empyema in pneumonia, 224, 229  
 Eosinophiles and their diagnostic value, 250  
 Epilepsy, surgical treatment of, 303  
 Epithelioma, 262  
     adamantine, 265  
 Erysipelas, 225  
 Exophthalmic goitre, 211, 248  
     operative treatment of, 270

**F**

Fæces, examination of, 79  
     in dysentery, 228  
 Fibroid tumors of the uterus, surgical treatment of, 156  
 Fixation abscesses, 128  
 Flick, Lawrence F., The way of infection in tuberculosis, 171  
 Fordyce, A. Dingwall, Some records of the value of the opsonic test for diagnosis, and of the employment of vaccines in certain infective conditions in children, 40  
 Formic acid in diphtheria, 197  
 Fracture of the spine, 163  
 Frank, Louis, The import of digestive disturbances in the diagnosis of surgical lesions of the abdomen, 123

**G**

Gallbladder, autoinfection from, 223  
     diseases of, 89  
     hydrops of, 92  
     inflammation of, 90, 92  
     operations on, 286  
     pathology of, 91  
     rupture of, 91  
     technique of operations of, 100  
 Gallducts, operations on, 286  
 Gallstones, 94, 233  
     and pancreatitis, 231  
     in common duct, signs of, 234  
 Gastritis, treatment of chronic, 219

Gastroenterostomy, 235  
 Gastrosuccorrhœa, 229  
 Gelatine in hæmorrhage, 144  
 Goitre, exophthalmic, 211, 248  
     operative treatment of, 271  
     substernal, 271  
 Gout, 208  
 Grocco's sign, 229  
 Gualacool in rheumatoid arthritis, 209

H

Hæmoglobinuric fever, etiology of, 174  
 Hæmolytic test in disease, 245  
 Hæmophilia, blood coagulation in, 37  
 Hæmoptysis, 218  
 Hæmorrhage, blood coagulation in, 37  
     from lungs in mitral stenosis, 237  
     in newborn, 143  
 Hands, cleansing of, 260  
 Hay fever, 217  
 Heart, acute overstraining of, 235  
     affections, chronic, 213  
     aneurism of, 236  
 Heartblock, 239  
 Heart, chronic muscular disease of, 237  
     congenital disturbance of, 236  
     functional power of, 235  
     hereditary disease of, 237  
     paroxysmal, arrhythmia of, 238  
     syphilis of, 239  
     tumor of, 237  
 Hepatic artery, aneurism of, 240  
 Hermophenyl in syphilis, 29  
 Heroin in influenza, 196  
 Hernia, inguinal, 292  
     strangulated, gangrenous, 297  
 Hirschsprung's disease, 298  
 Hyperæmia treatment, in gout, 208  
     in infected wounds, 261  
     in rheumatism, 200  
 Hysterectomy, technique of, 159

I

Ignipuncture, 130  
 Immunity and textural proclivities, 72  
 Infantilisim, 248  
 Influenza, 196  
 Interauricular insufficiency, 236  
 Intertrigo in the newborn, 150  
 Intestinal bacteria, 232  
     putrefaction, 231  
 Intestines, carcinoma of large, 301  
     extensive resection of, 291  
     obstruction of, 288  
     surgery of, 301  
 Intratracheal injections, 205

J

Jaundice, blood coagulation in, 38  
     causes of, 234  
 Jaws, dentigerous cyst of, 265  
 Joint, tuberculosis of, 116  
 Joints, surgery of, 276

K

Kernig's sign in meningitis, 225  
 Kidneys, inflammation of, 216  
     surgery of, 304

L

Lactate of mercury in syphilis, 29  
 Leukæmia, acute, 251  
     lymphatic, spirochæta in, 247  
     lymphatic, 250  
     Roentgen rays in, 246  
 Leucocytes, 250  
 Liver, abscess of, in dysentery, 238  
     urine in cirrhosis of, 67  
 Lungs, hæmorrhage from, in mitral stenosis, 237

M

Magnesium sulphate, in tetanus, 203  
 Malaria, 174, 199, 225  
     prophylaxis against, 225  
 Malta fever, 228  
 McMurtry, Lewis S., The perfected surgical treatment of fibroid tumors of the uterus, 156  
 Meningitis, 224  
     opsonic index in, 42  
     serum, 224  
     vaccination in, 46  
 Meningococcus, opsonic index against, 42  
 Mercurial injections in syphilis, 22  
     technique of, 25  
     salts, soluble and insoluble, 23  
 Mercury to prevent syphilis, 205  
 Mitral regurgitation, pulmonary sounds in, 237  
     stenosis, pulmonary hæmorrhage in, 237  
     valve, tumor of, 237  
 Mucous colitis, 77  
 Myocarditis, chronic, 237  
 Myxædema, 210, 247  
 Myxoma of bone, 269

N

Naso-pharangeal tumors, 266  
 Nephritis, diet and treatment of, 216  
     of scarlet fever, 195



Nerves, surgery of peripheral, 303  
 Neurasthenia, symptoms of, 78  
 Newborn, care of, 141  
 Nisbet, Verner and Edsall, David J.,  
 Medicine, 220  
 Nursing the newborn, 151

## O

Ophthalmia neonatorum, 152  
 Ophthalmic-toxic test in typhoid fever,  
 222  
 Ophthalmic-tuberculin test, 221  
 Opium in diabetes, 207  
 Opsonic index, 244, 246  
     in tuberculosis, 203  
     test in diagnosis, 40  
     technique of, 41

## P

Palate, ulceration of, in typhoid fever,  
 222  
 Pancreas, acute inflammation of, 231  
     necrosis of, 232  
 Pancreatitis and gallstones, 232  
 Paracolon bacilli in paratyphoid fever,  
 54  
 Parathyroid gland, 248  
 Paratyphoid bacillus, 54  
     fever, 54  
     diagnosis of, 55  
     symptoms of, 54  
 Pericardial effusion, 240  
 Phagocytes and leucocytes, 250  
 Phenolphthalein to test urinary acid-  
 ity, 61  
 Pilocarpine nitrate in nephritis, 216  
 Plethora, true, 249  
 Pleurisy, 218, 229  
 Pneumonia, 193, 223  
     and empyema, 224  
     epidemic of, 223  
     in children, 193  
     unresolved, 194  
 Polycythemia, 249  
 Potassium iodide, in gout, 209  
 Pregnancy and fibroids, 161  
 Puerperal septicemia, fixation ab-  
 scesses in, 129  
 Pulsus paradoxus, 240  
 Pyocyanase in diphtheria, 197  
 Pyosalpinx and fibroids, 160

## Q

Quinine, in influenza, 196  
     in malaria, 199, 225  
     in blackwater fever, 177

## R

Rectum, carcinoma of, 301  
 Rheumatic diplococcus, opsonic index  
 against, 51  
 Rheumatism, 200  
     vaccination in, 51  
 Rheumatoid arthritis, 209  
 Roentgen rays, in exophthalmic goitre,  
 211  
     in leukemia, 246  
     in unresolved pneumonia, 194  
 Rudolf, R. D., The normal tempera-  
 ture of the body, 82

## S

Salicylates, in influenza, 196  
     in rheumatism, 200  
 Sanatorium, The, 1  
     construction of, 3  
     objects of, 12  
     history of, 1  
     suitable sites for, 2  
     treatment in, 15  
 Sarcoma, giant cell, 267  
     of breast, 276  
     of heart, 237  
 Scarlet fever, 194  
 Secretin in diabetes mellitus, 203  
 Septicemia, treatment of, 132  
 Serum treatment of exophthalmic  
 goitre, 212  
 Sherrill, J. Garland, Resection of the  
 shoulder joint for suppurative dis-  
 ease of the bone, 113  
 Shoulder joint, resection of, 113  
 Sigmoid, volvulus of, 299  
 Sleeping sickness, 228  
 Sommerville, David, Mucous colitis, 77  
 Spinal cord, symptoms of crush of, 163  
 Spine, surgery of, 303  
 Spirochæta in acute lymphatic leu-  
 kemia, 247  
 Splenomegaly, 249  
 Sputum, care of, 12  
 Staphylococcic vaccine, 50  
 Staphylococcus, opsonic index against,  
 50  
 Stevens, A. A., Treatment, 190  
 Stomach, acidity of, and urinary acid-  
 ity, 59  
     acute dilatation of, 220  
     carcinoma of, 283, 285  
     chronic inflammation of, 218  
     operation for perforated ulcer  
     of, 105  
     operations on, 282  
     phlegmonous inflammation of,  
     230  
     ulcer of, 219, 284

Suture material, 260  
 Syphilis, 205, 226  
     and aneurism, 215  
     serum diagnosis of, 226  
     simulating typhoid fever, 226  
     treatment with mercurial injections, 22  
 Syphilitic fever, 226

T

Tachycardia, 239  
     operative treatment of, 270  
 Technique, operative, 259  
 Telangiectasia circumscripta universalis, 241  
 Temperature, in the newborn, 148  
     normal, of body, 82  
 Testicle, surgery of, 304  
 Testmeal, 65  
 Tetanus, 201  
 Theosin injections in heart disease, 214  
 Thiosinamine in heart disease and arterio-sclerosis, 214  
 Thiruloix, Jules, On fixation abscesses, 128  
 Thrush in the newborn, 149  
 Thyroidectomy in exophthalmic goitre, 211  
 Thyroid, extract in myxœdema, 210  
     gland, overactivity of, 248  
     surgery of, 270  
 Tilton, Benjamin T., Practical deductions from a series of operations for perforated gastric and duodenal ulcer, 105  
 Tongue, ulcer of, 263  
 Tricuspid insufficiency, 235  
 Tubercle bacillus, opsonic index against, 47  
     relation of human and bovine, 220  
 Tuberculin, 203  
     test, 221  
     treatment, 49  
 Tuberculosis, 203, 220  
     cremation in, 220  
     etiology of, 220  
     history taking in, 9  
     of humerus, 115  
     prognosis in, 14  
     treatment of, in sanatoria, 15  
     way of infection in, 171

Tuley, Henry Enos, The care of the newborn, 141  
 Turpentine to produce artificial abscesses, 133  
 Typhoidal cholecystitis, 93  
 Typhoid, bacillus carriers, chronic, 223  
     fever, 190, 222  
     blood in, 223  
     early diagnosis of, 222, 250  
     pathogenesis of, 222

U

Ulcers, perforating gastric and duodenal, 105  
     symptoms of perforating gastric and duodenal, 107  
 Umbilical cord, dressing of, 146  
     ligation of, 142  
 Urinary and gastric acidity, 59  
 Urine, acidity and alkalinity of, 59  
     in hepatic cirrhosis, 67  
 Urotropin in scarlet fever, 195  
 Uterus, surgical treatment of fibroids of, 156

V

Vaccination, against bubonic plague, 227  
     against infections, 262  
     against whooping-cough, 199  
     antityphoid, 191  
 Vaccines in infectious disease of children, 40  
 Varicose aneurism of vena cava and aorta, 241  
 Vena cava and aorta, varicose aneurism of, 241  
 Vertebrae, fracture of, 163  
 Volvulus of sigmoid, 299

W

Walton, G. L., Fracture of spine, 163  
 Whooping-cough, 193  
 Wilson, J. C., The paratyphoid fevers, 54





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